

A Competitiveness Evaluation of the Ukrainian Regions – Empirical Study

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The topic of the article is an empirical evaluation of regional competitiveness of the Ukrainian regions. The position of 27 Ukrainian regions was analyzed by the means of multivariate statistical methods respecting the multidimensional character of selected social economic variables. The current variables were obtained from the database of State Statistics Service of the Ukraine. Chosen data sets are suitable for describing fields such as Industry, Investment, Household Income, Wages and Their payment, Labour Market, Demographic situation, Environment. By the factor analysis the data sets were reduced and the authors of the article identified four regional competitiveness factors (Economic Development Factor, Industrial Production Factor, Migration and Employment Rate Factor, Labour Market Factor). Factor scores were obtained as an additional result of the factor analysis and consequently were used as input variables for the cluster analysis. As the result of the multivariate classification the groups of regions with similar levels of regional competitiveness were found. The results of cluster analysis were evaluated by means of a dendrogram in two linkage distances. When the higher distance level (linkage distance equal to 7, Ward method, Euclidean distance) was applied, the original number of 27 regions naturally formed two clusters. By decreasing the linkage distance from the original one to the new lower distance equal to 4, we can get a more detailed classification of Ukrainian regions. The created regional clusters are discussed in the article regarding their current regional competitiveness and economic development.

Keywords: *regional competitiveness, factors of competitiveness, factor analysis, cluster analysis, multivariate classification techniques.*

Introduction

The evaluation, measurement and analysis of the competitiveness of the EU regions is currently the subject-matter of a whole range of economic studies based on the interpretation of the term regional competitiveness as the ability to produce goods and provide services able to maintain their position on the final product market and to achieve sustainable level of income and employment rate (Kitson *et al.*, (2004); Lengyel (2003); Martin (2003); Odehnal, Michalek (2009, 2011); Viturka (2007)). It is therefore clear from the definition that ability of enterprises to produce competitive products and services depends on e.g. the quality of regional business climate that can be evaluated by means of factors existing in the region. The authors like Martin (2003). Porter (1998), include among these factors the following: quality and availability of infrastructure, quality of human resources, demographic situation in the regions, level of research and science in the regions, innovations, etc. The quantification and computation of such variables is the basis of selected analyses evaluating regional competitiveness. The aim of this paper is to analyse regional competitiveness of the Ukrainian regions in the form of typology of regions on theoretical basis presented by the authors Odehnal, Michalek (2009, 2011); Viturka (2007) and applied to the regions of the EU Member States. To get the final typology, the authors employ multivariate statistical techniques (factor analysis, cluster analysis) which were used for solving the problems of various types of classification in economy (Odehnal *et al.*, (2011), Odehnal

et al., (2009); Vojtkova, Kvetan (2009) reflecting the multivariate nature of data analysed.

Empirical Studies Focusing on the Evaluation of Regional Competitiveness

The term of competitiveness is based on definitions published by Martin (2003), Porter (1998) and presents widely defined problems which could be specified on the level of national competitiveness Thompson (2004); Umirzakov (2007)) and on the level of regional competitiveness Odehnal, Michalek (2009, 2011); Viturka (2007) or on the level of company competitiveness.

The multivariate competitiveness analysis of selected Ukrainian regions is based on competitiveness factors defined in Martin, R. (2003). The empirical analysis of regional competitiveness is based on the definition of competitiveness published in Martin, (2004) according to which competitiveness is the ability of regions to generate high income and employment rate. The authors of the study identify 3 main factors of regional competitiveness:

- 1) Infrastructure and Infrastructure Availability Factor,
- 2) Human Resources Factor,
- 3) Productive (Economic) Environment Factor.

Similar studies which are focused on the evaluation of competitiveness or on examination of relationship between the level of regional competitiveness and economic development of nations could be find in scientific journals Berger (2008); Garelli (2009); Kochetkov (2005); Lengyel (2003); Nurmukhanova (2008); Odehnal, Michalek (2007).

Characteristics of Data Used

Data selected for the regional competitiveness evaluation derive from the database of the Ukrainian Statistical Office (State Statistics Service of the Ukraine, (2010)) that publishes regional data characterizing 14 subject areas given in Table 1.

The regional competitiveness of 27 regions (Autonomous Republic of Crimea, Vinnytsya, Volyn, Dnipropetrovsk, Donetsk, Zhytomyr, Zakarpattia, Zaporizhzhya, Ivano-Frankivsk, Kyiv, Kirovohrad, Luhansk, Lviv, Mykolayiv, Odesa, Poltava, Rivne, Sumy, Ternopil, Kharkiv, Kherson, Khmelnytskyi, Cherkasy, Chernivtsi, Chernihiv, City of Kyiv, City of Sevastopol) is evaluated in the text below in compliance with 15 variables based on the subject areas shown in bold in Table 1.

Table 1

Social and economic indicators of the Ukrainian regions

| <i>Subject Area</i> | <i>Variable</i> |
|--|--|
| Industry | Indices of industrial production Volume of industrial products sold |
| Agriculture | Indices volume of agricultural production Head of livestock and poultry Main kinds of animal production Production of main agricultural crops Average sale price of agricultural products |
| <i>Subject Area</i> | <i>Variable</i> |
| Fishery | Fish catching and extracting of sea products |
| Investment and construction activity | Investment in fixed capital Putting the dwellings into service Indices for the volume of construction work |
| Export-Import of commodities and services | Exports-Imports of commodities Exports-Imports of services |
| Trade and restaurant economy | Retail turnover Retail turnover of enterprises engaged |
| Prices | Consumer price index |
| Finances | Financial results of general activity of enterprises before taxation Revenue of enterprises |
| Household income | Household income and expenditure |
| Wages and their payment | Average wages and salaries |
| Labour Market | Economically active population Economic activity rate of population Employment Employment rate of population Unemployment Unemployment rate of population Demand of enterprises for employees |
| Demographic situation | Total population Natural population increase Migration of population |
| Environment | Emissions of pollutants and carbon dioxide into the atmosphere Main indicators of forestry Main indicators of waste disposal |
| Creation and use of secondary sources, scrap and waste | Creation and use of secondary sources and industrial waste |

(source: table created by the authors)

The variables are as follows: gross regional product per capita, index of industrial production, share of region in the total volume of industrial production sold, capital investment by region, disposable income per capita, average wages, economic activity rate of population, employment rate of population, unemployment rate of population, total arrivals to the Ukraine (per 1,000 of the current population), total departures from the Ukraine (per 1,000 of the current population), volume of emissions including stationary sources, volume of emissions including mobile sources, carbon dioxide emissions (not included in total emissions) including stationary sources, carbon dioxide emissions (not included in the total) including emissions from mobile sources. The selected 15 regional variables characterizing the competitiveness of 27 Ukrainian regions are used in the text below as input variables to create regional competitiveness factors by means of factor analysis. The factor score characterizing every region forms the basis for multivariate classification compiled out by means of cluster analysis.

Regional Competitiveness Factors and Their Use for the Classification of Regions

The factor analysis performed to create regional competitiveness factors is a suitable method for reducing the number of variables characterizing the competitive position of the Ukrainian regions.

The result of factor analysis is the identification of regional competitiveness factors and the computation of the factor score used as input data for cluster analysis.

The number of estimated factors has been selected on the basis of two criteria (Kaiser Criterion and the cumulative percentage of explained variance criterion) described in Johnson, Wichern (1992). By applying Kaiser Criterion, where the number of factors is determined pursuant to the number of eigenvalues greater than 1, the authors have determined 4 final regional competitiveness factors. Using these criteria it can be seen from the Table 2 that the cumulative percentage of explained variance is 87.411 which overcome recommended minimum 70 per cent.

Table 2

Results of Factor analyses

| Factor no. | Eigenvalue | % of explained variance | Cum. % of explained variance |
|------------|------------|-------------------------|------------------------------|
| 1 | 7.098 | 47.319 | 47.319 |
| 2 | 2.559 | 17.058 | 64.376 |
| 3 | 2.279 | 15.192 | 79.569 |
| 4 | 1.176 | 7.842 | 87.411 |

(source: table created by authors)

Further factors obtained by principal component method were rotated by varimax normalized rotation method Johnson, Wichern (1992). The rotated factor loading matrix is given in the Table 3. This approach proved itself good in former statistical analyses which dealt with the European Union states classification. Odehnal, Michalek (2009, 2011). For consecutive interpretation only the factor loadings the absolute value of which is greater than 0.5 have been used. This way and

taking into account only the variables which saturate individual factors allowed associating the name to each factor as follows:

- Factor 1: *Economic Development Factor*;
- Factor 2: *Industrial Production Factor*;
- Factor 3: *Migration and Employment Rate Factor*;
- Factor 4: *Labour Market Factor*.

The factor score computed as the factor analysis output has been used as input variables for cluster analysis

selected by the authors with the aim of classifying the 27 Ukrainian regions characterized pursuant to the regional competitiveness factors. The result of cluster analysis (Ward method, the Euclidean distance) shows the classification of regions into homogenous groups graphically represented in a dendrogram in Figure 1 and in maps in other Figures.

Table 3

Rotated factor loading matrix

| | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|-----------|-----------|-----------|-----------|
| Share of region in the total volume of industrial production sold | 0,316061 | 0,926500 | -0,020249 | 0,030868 |
| Capital investment by region | 0,947678 | 0,233782 | -0,010343 | 0,115602 |
| Disposable income per capita | 0,905370 | 0,135895 | 0,078515 | 0,266027 |
| Average wages and salaries | 0,884802 | 0,252020 | -0,134021 | 0,190291 |
| Economic activity rate of population | 0,209706 | -0,012234 | 0,150038 | 0,940196 |
| Employment rate of population | 0,465894 | -0,012567 | -0,116538 | 0,831433 |
| Unemployment rate of population | -0,634117 | 0,010792 | 0,544477 | -0,044647 |
| Total arrivals to the Ukraine (per 1,000 of the current population) | 0,056418 | -0,140972 | 0,928357 | 0,163815 |
| Total departures from the Ukraine (per 1,000 of the current population) | -0,198488 | -0,024450 | 0,950197 | 0,056549 |
| Volume of emissions including stationary sources | 0,153107 | 0,969880 | -0,065186 | -0,041938 |
| Volume of emissions including mobile sources | 0,801640 | 0,514003 | 0,003226 | 0,041514 |
| Carbon dioxide emissions (not included in total emissions), including emissions from stationary sources | 0,209627 | 0,930830 | -0,052262 | -0,019044 |
| Carbon dioxide emissions (not included in total emissions) including emissions from mobile sources | 0,771056 | 0,494843 | 0,014211 | 0,001747 |
| Gross regional product per capita | 0,935343 | 0,093210 | 0,003098 | 0,232958 |
| Index of Industrial Production | 0,153112 | 0,039488 | 0,483445 | -0,332558 |
| % of explained variance | 0,367275 | 0,222824 | 0,157522 | 0,126486 |

(source: table created by authors)

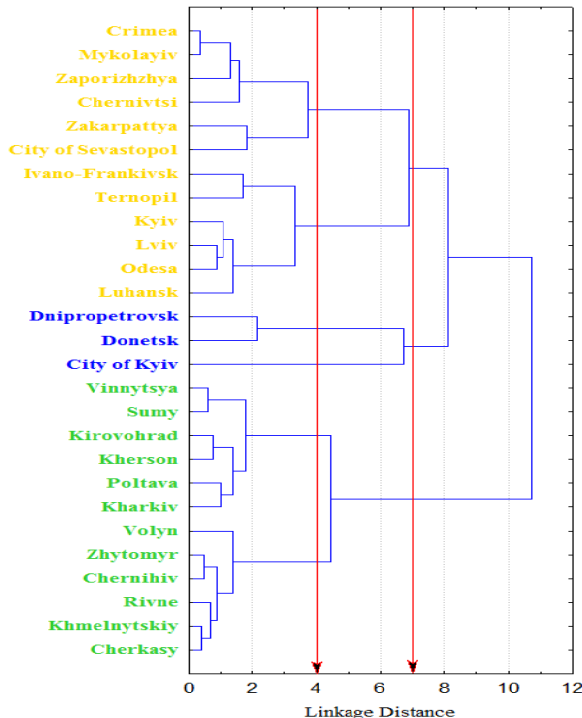


Figure 1. Dendrogram

(source: figure created by the authors)

The dendrogram at linkage distance 7 corresponds to the map in Figure 2 and clearly shows the classification of regions into 3 clusters:

1) The first cluster (green in Figure 1) consists of 12 regions:

- Cherkasy, Khmelnytskiy, Rivne, Chernihiv, Zhytomyr, Volyn, Kharkiv, Poltava, Kherson, Kirovohrad, Sumy, Vinnytsya.

2) The second cluster (blue in Figure 1) consists of 3 regions:

- City of Kyiv, Donetsk, Dnipropetrovsk.

3) The third cluster (yellow in Figure 1) consists of 12 regions:

- Luhansk, Odesa, Lviv, Kyiv, Ternopil, Ivano-Frankivsk, City of Sevastopol, Zakarpattya, Chernivtsi, Zaporizhzhya, Mykolayiv, the Autonomous Republic of Crimea.

By decreasing the linkage distance from the original one to the new distance 4, (Fig. 1) we can get more detailed classification of the regions represented in the dendrogram and the map in Figure 3. The Figure shows the classification of 27 regions into 6 clusters differing in the levels of regional competitiveness factors. The first cluster consists of 6 regions (Cherkasy, Khmelnytskiy, Rivne, Chernihiv, Zhytomyr, Volyn), the second cluster of 6 regions (Kharkiv, Poltava, Kherson, Kirovohrad, Sumy, Vinnytsya), the third cluster includes the only region of the City of Kyiv, the fourth cluster consists of 2 regions (Donetsk, Dnipropetrovsk), the fifth cluster of 6 regions (Luhansk, Odesa, Lviv, Kyiv, Ternopil, Ivano-Frankivsk)

and the sixth cluster consists of the remaining 6 regions (City of Sevastopol, Zakarpattya, Chernivtsi, Zaporizhzhya, Mykolayiv, the Autonomous Republic of Crimea).

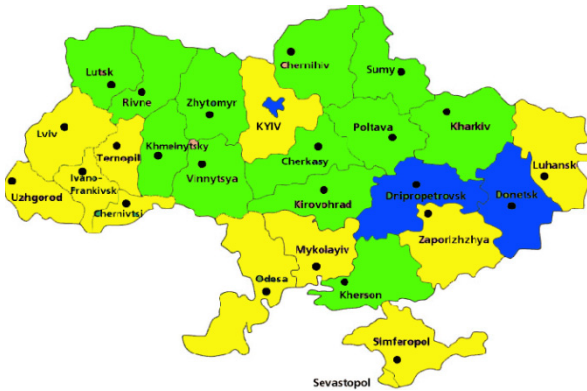


Figure 2. Map corresponding to the dendrogram with the linkage distance 7
(source: figure created by the authors)



Figure 3. Map corresponding to the dendrogram with the linkage distance 4
(source: figure created by the authors)

The Interpretation of Created Clusters

The results of cluster analysis carried out at linkage distance 4 represent the final classification of 27 regions into 6 clusters that are shown in the Figures (4, 5, 9 and 10) below on the basis of average factor score for every cluster and factor. A closer analysis of the first regional competitiveness factor and the average factor score shown in Figure 4 indicates the dominant position of the cluster No. 3, i.e. the cluster formed by the capital of the Ukraine, which confirms the well-known effect of the capital city. It is clear from economic variables saturating the competitiveness factor (the authors consider factor loadings greater than 0.5 to be significant) that the region achieves above average values in the regional GDP indicator as well as e.g. in the average wages and salaries indicator. You can see the comparison of both indicators presented above and the interregional differences in box graphs in Figures 6 and 7.

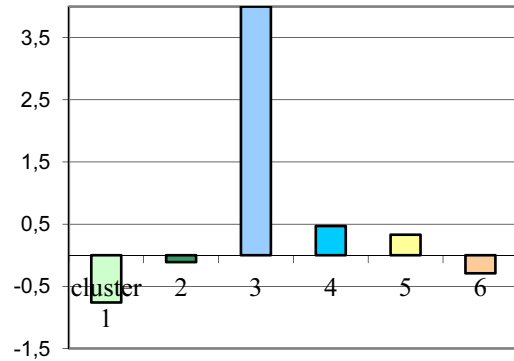


Figure 4. Economic Development Factor
(source: figure created by the authors)

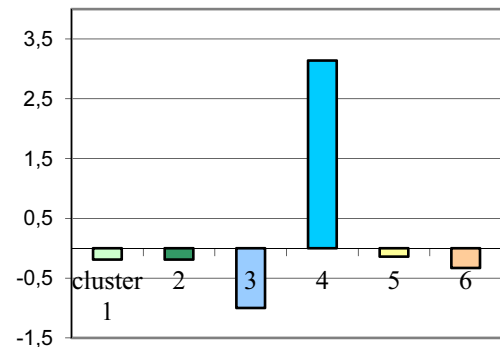


Figure 5. Industrial Production Factor
(source: figure created by the authors)

Figures 6 and 7 show graphical representation of the highest interregional differences of two regional variables saturating factor 1. Figure 6 shows the disparities between the values of the basic macroeconomic variable, i.e. Gross Domestic Product reflecting the actual economic development of the given region. Figure 7 shows the dominant position of the region of the capital that is the centre of the tertiary sector of the Ukrainian economy generally characterized by higher average salaries in comparison with the primary and secondary sectors.

The Industrial Production Factor is saturated especially by variables reflecting the actual output of manufacturing industry in comparison with other sectors as well as indicators of air pollution as a negative aspect of prevailing heavy engineering. In Figure 5 showing average values of the industrial production factor, we can see the highest values in the cluster No. 4. It is possible to detect regions forming this cluster by studying the cluster structure in detail. The regions are: Donetsk (mining industry) and Dnipropetrovsk (arms and metallurgical industries), i.e. regions representing important industrial centres of the country. One of the negative aspects of heavy industry situated in these regions is its adverse effect on the environment the quality of which is analysed by means of a variable evaluating the quality of air in selected regions. Figure 8 therefore shows a considerable difference in air pollution measured on the basis of volume of pollutants emissions.

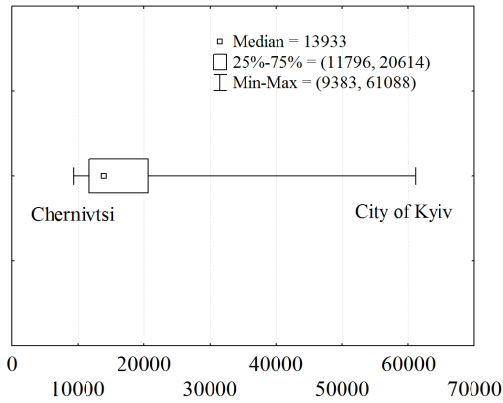


Figure 6. Gross Regional Product per capita (UAH)
(source: figure created by the authors)

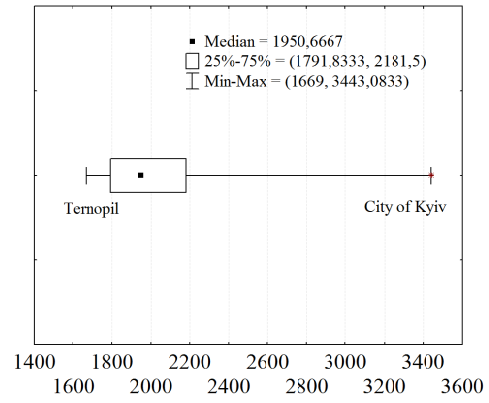


Figure 7. Average salaries (UAH)
(source: figure created by the authors)

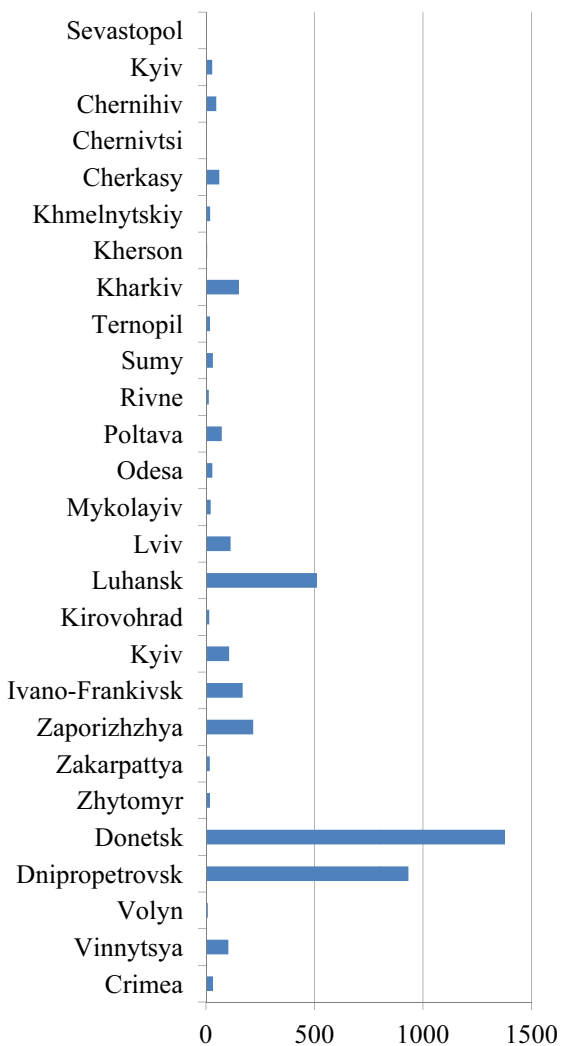


Figure 8. Volume of regional pollutants emissions (thousand tons)
(source: figure created by the authors)

Finally, the Migration and Unemployment Factor will be discussed. It can be concluded from Figure 9 that this factor describes the attractiveness of the region and through the unemployment rate indicator also the basic review of the situation in the labour market where the

Autonomous Republic of Crimea region has a comparatively favourable position (unemployment rate 6.3 %). On the other hand, the highest values can be seen in the clusters No. 2 and No. 1 consisting mainly of agricultural regions, which reflects the seasonal nature of agricultural activities and therefore varying labour market outcomes throughout the monitored year 2010.

The average values of the Labour Market Factor presented in Figure 10 confirm the dominant position of the metropolitan region of the City of Kyiv that can be characterized as the region showing a high rate of economic activity of the population and high employment rate. Thus for example the key labour market indicator for the City of Kyiv of 6.3 % surpasses the average in the EU (9.6 %) as well as some metropolises such as Paris, Brussels, Berlin or Madrid.

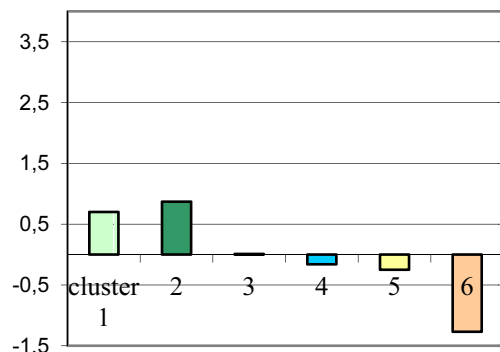


Figure 9. Migration and Employment Rate Factor
(source: figure created by the authors)

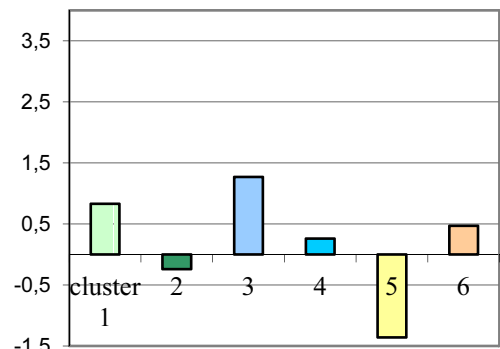


Figure 10. Labour Market Factor
(source: figure created by the authors)

Conclusions

The regional competitiveness evaluation of the Ukrainian regions is an empirical regional analysis based on real data published by the Statistical Office of the Ukraine. The multivariate data obtained was processed by performing factor analysis that made it possible to decrease the number of 15 regional variables to 4 factors of regional competitiveness. The authors created the Economic Development Factor, Industrial Production Factor, Migration and Unemployment Factor and Labour Market Factor. The first factor was saturated by the following variables: capital investment by region, disposable income per capita, average wages and salaries, unemployment rate of population, volume of emissions including mobile sources, carbon dioxide emissions (not included in total emissions) including emissions from mobile sources, gross regional product per capita. The second factor is saturated by the variables share of region in the total volume of industrial production sold, volume of emissions including stationary sources, volume of emissions including mobile sources, carbon dioxide emissions (not included in total emissions), including emissions from stationary sources. The third factor is saturated by the variables unemployment rate of population, total arrivals to the Ukraine (per 1,000 of the current population), total departures from the Ukraine (per 1,000 of the current population) and the fourth factor is saturated by economic activity rate of population, employment rate of population.

The regions were classified into groups on the basis of the factor score used as the input variable for cluster analysis. More detailed classification at the linkage level $h = 4$ indicates major differences especially between the cluster No. 3 consisting of the City of Kyiv region and other Ukrainian regions. The results of regional analysis revealed significant industrial regions (cluster No. 4

Donetsk, Dnipropetrovsk) which, however, suffer from strong adverse effects on the environment. The authors compiled a multivariate classification of the Ukrainian regions reflecting the current regional macroeconomic and microeconomic variables the high values of which describe great economic potential of some regions that, however, may contradict the current concept of sustainable development. The used applied multivariate statistical techniques respect the multidimensional character of data, which allow the authors to include all accessible variables.

The advantage of the used approach is the fact that the Ukrainian regions mentioned were described by four identified factors, not by all fifteen accessible economic variables (fifteen randomly fluctuated variables). Described approach led to significant data reduction without the loss of information. Such a reduction in the dimensions of the problem is in economic practice always profitable. The identification of regional competitiveness factors was based on current economic theory published in Martin (2003), Garelli (2009). The regional classification as a result of cluster analysis was created by computed factor scores characterized the position of 27 Ukrainian regions.

The limitation of results is the fact that the classification describes the level of regional competitiveness just throughout the monitored year 2010. The time stability of empirical factors was not investigated in the article, which should be future research development.

The chosen multivariate approach to regional competitiveness thus can be used for solving problems of various types of classification of modern economics theory. The information obtained from the factor and cluster analysis should be used as supportive tool for the subjects of the Economy Policy.

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Ukrainos regionų konkurencingumo įvertinimas

Santrauka

ES regionų konkurencingumo įvertinimas, nustatymas ir analizė šiuo metu yra vienas iš prioritetinių ekonomikos darbų, pagrįstų regioninio konkurencingumo termino, kaip gebėjimo gaminti prekes ir teikti paslaugas, galinčias išlaikyti savo pozicijas užbaigto gaminio rinkoje ir pasiekti tvirtą pajamų lygį ir įdarbinimo tempą, interpretacija (Kitson, Martin ir Tyler (2004), Lengyel (2003), Martin (2003), Odehnal ir Michalek (2009, 2011), Viturka (2007)). Todėl iš apibrėžimo aišku, kad įmonių gebėjimas kurti konkurencingus gaminius ir paslaugas priklauso nuo regioninio verslo klimato, kokybės, kuri gali būti įvertinta remiantis regione egzistuojančiais veiksniais.

Ekonomikos tyrėjai Martin (2003), Porter (1998), greta šių veiksnių įvardina ir infrastruktūros kokybę ir tinkamumą, žmoniškųjų resursų kokybę, regionų demografinę padėtį, tyrimų ir mokslo lygį regionuose, inovacijas, ir t.t. Įvertinant regiono konkurencingumą, tokių kintamųjų kiekio nustatymas ir suskaičiavimas sudaro pasirinktos analizės pagrindą.

Šio darbo tikslas – išanalizuoti Ukrainos regionų konkurencingumą naudojantis regionų tipologijos forma ir remiantis teoriniu pagrindu, kuri pateikė autoriai Odehnal ir Michalek (2009, 2011), Viturka(2007) ir pritaikė ES šalių narių regionams. Norėdami gauti galutinę tipologiją, autoriai naudojo įvairius statistinius būdus, kurie buvo naudojami sprendžiant įvairių tipų klasifikavimo problemas (Odehnal, Sedlačík, Michálek (2011), Odehnal, Neubauer ir Michalek (2009)), parodančias įvairiapusę analizuojamų duomenų esmę.

27 regionų (Krymo autonominė respublika, Vinicia, Voluinė, Dniepropetrovskas, Doneckas, Žytomyras, Užkarpatė, Zaporožė, Ivano-Frankivskas, Kijevas, Kirovohradas, Luhanskas, Lvovas, Mykolajevas, Odesa, Poltava, Rivnė, Sumai, Ternopolis, Charkovas, Chersonas, Chmelnyckis, Čerkasai, Černivciai, Černigovas, Kijevo miestas, Sevastopolio miestas) regioninis konkurencingumas įvertinamas naudojantis pasirinktais regioniniais kintamaisiais.

Kintamieji yra tokie: bendrasis regioninis produktas žmogui, pramoninės produkcijos indeksas, regiono dalis bendrai parduotos pramoninės produkcijos mastu, regiono kapitalo investicijos, grynosios pajamos žmogui, vidutinis darbo užmokestis, gyventojų ekonominės veiklos koeficientas, gyventojų įdarbinimo koeficientas, gyventojų nedarbo koeficientas, bendras atvykstančiųjų į Ukrainą skaičius (1000-čiui dabartinio gyventojų skaičiaus), bendras išvykstančiųjų iš Ukrainos skaičius (1000-čiui dabartinio gyventojų skaičiaus), emisijos apimtis, įskaitant stacionarius šaltinius, emisijų apimtis, įskaitant judančius šaltinius, anglies dvideginio išskyrimas (neįtrauktas į bendrą emisiją) įskaitant stacionarius šaltinius, anglies dvideginio išskyrimas (neįtrauktas į bendrą emisiją) įskaitant judančių šaltinių emisiją.

Įvairūs duomenys, kuriuos paskelbė Ukrainos statistikos departamentas, buvo apdoroti atliekant veiksnių analizę, kuri leido sumažinti 15 regioninių kintamųjų skaičių iki 4 regioninio konkurencingumo veiksnių. Autoriai sukūrė šiuos veiksnys: ekonominės plėtros, pramoninės produkcijos, migracijos, nedarbo ir darbo rinkos.

Pirmasis veiksnys buvo užpildytas tokiais kintamaisiais: regiono kapitalo investavimas, grynosios pajamos žmogui, vidutinis uždardis ir atlyginimas, gyventojų nedarbo koeficientas, emisijos apimtis įskaitant judančius šaltinius, anglies dvideginio išskyrimas (neįtrauktas į bendrą emisiją įskaitant emisiją iš judančių šaltinių), bendrasis regiono produktas žmogui.

Antrasis veiksnys buvo užpildytas tokiais kintamaisiais: regiono dalis bendrai parduotos pramoninės produkcijos mastu, emisijos apimtis įskaitant stacionarius šaltinius, emisijos apimtis įskaitant judančius šaltinius, anglies dvideginio išskyrimas (neįtrauktas į bendrą emisiją), įskaitant emisiją iš stacionarių šaltinių. Trečiasis veiksnys buvo užpildytas tokiais kintamaisiais: gyventojų nedarbo koeficientas, bendras atvykstančiųjų į Ukrainą skaičius

(1000-čiui dabartinio gyventojų skaičiaus), bendras išvykstančiųjų iš Ukrainos skaičius (1000-čiui dabartinio gyventojų skaičiaus), o ketvirtasis veiksnys buvo užpildytas tokiais kintamaisiais: gyventojų ekonominės veiklos koeficientas, gyventojų įdarbinimo koeficientas. Regionai buvo suklasifikuoti į vienodas grupes pagal veiksnio vertę, panaudotą kaip *klasterio* analizės įvesties kintamasis. Klasterio analizės rezultatai grafiškai pateikti dendrogramoje. Dendrogramą sudaro trys diagramos ir dvi papildomos statmenos ašys, kurioje atskiri sugrupuoti objektai pavaizduojami išilgai vienos ašies, o sujungimo atstumo vertės (atstumai tarp sugrupuotų objektų) išilgai kitos ašies. Daug smulkesnis klasifikavimas sujungimo lygyje $h = 4$ parodo svarbiausius skirtumus, ypač tarp klasterio Nr. 3, kurį sudaro Kijevo miesto regionas, ir kitų Ukrainos regionų. Regioninės analizės rezultatai parodė svarbius pramoninius regionus (klasteris Nr. 4 Doneckas, Dniepropetrovskas) kurie, deja, daro stiprią nepalankią įtaką aplinkai. Autoriai sudarė įvairiapusišką Ukrainos regionų klasifikaciją atspindinčią dabartinius regioninius makroekonominius ir mikroekonominius kintamuosius, kurių aukštos vertės apibūdina didelį kai kurių regionų potencialą, kuris gali prieštarauti dabartinei nuoseklos plėtros koncepcijai.

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Raktažodžiai: *regioninis konkurencingumas, konkurencingumo veiksniai, veiksmų analizė, klasterio analizė, įvairūs klasifikavimo būdai.*

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