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EVALUATION OF RURAL DEVELOPMENT PROCESSES IN THE LUBLIN REGION USING SIMILARITY MEASURES[***]

1. INTRODUCTION

Rural areas in Poland are highly diverse in economic, social and structural terms, understood as the intensity and method of development and use of space, both at the regional level and in relation to urban centers, their rural facilities and the periphery (Heffner, Rosner 2005, pp. 187–200). A multitude of factors, significantly affecting the rate and direction of changes occurring in rural areas, result in significant differences in socio-economic development, potential development, as well as different susceptibility to changes in the local scale (Heffner 2007, p. 11).

The state of rural development is essential to living conditions and to the possibility of economic use, and consequently, to the direction and pace of development. Generally, however, in the sense of space, in Poland, there predominate areas with lower level of socio-economic development, worse development opportunities and more difficult conditions for economic growth, which require raising the level and quality of life (Heffner, Rosner 2005, pp. 187–200).

This is due to following different paths of historical development on a local, regional and national scale, evolutionary or revolutionary changes of spatial arrangements and socio-economic impacts. Generally, however, rural residents are increasingly aware of the need for changes, improving quality of life and new opportunities, initiating and activating local environment. (Heffner 2011, pp. 56–57). Analyzing the spatial differentiation of the dynamics of socio-economic development of Poland, faster growth than in the east is in the western part of the country can be seen.. The vast majority of municipalities with low or below the average rate of development are the municipalities located in the eastern part, within the former Russian partition (Rosner 2010, p. 22).

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The study of the convergence of socio-economic development of rural areas in Poland conducted by A. Rosner indicates that, unifying trends in the territorial dimension are lost with those working towards further differentiation of the level of municipalities' development. The correlation between the scale at the achieved level of development and the dynamics of change amounted to r=0.608 (Rosner 2010, p. 23).

Disparities between better developed and backward areas are increasing, so we are dealing with a situation in which the impact of special cohesion policy, at best, delays spatial differences. This is probably because coherence programs are poorly targeted, while a great deal of the funds is allocated according to a key between the regions, their targeting within regions requires detailed analysis and possible corrections (Rosner 2010, p. 25).

Currently, rural spatial differentiation can be divided into at least three specific types: sub-urban areas, intermediate areas, peripheral areas.

For economic development, it is considered that, in Polish conditions, these features include: the intensity of the historical process transforming minor towns into rural areas, local economic structure, the characteristics of the agricultural sector, the characteristics of non-agricultural sector, the degree of sustainability of the local labor market and the abundance and infrastructural equipment of the area. In the case of agriculture, the existence of large-area farms was a beneficial situation, they were connected with markets and ran by people who had good preparation to be farm managers; agronomic features were not taken into account. Social component was analyzed on the basis of three characteristics: local demographic structure, issues related to education and social activity.

Each of these types occurs both in the east (less developed in socio-economic terms) and the west (more developed) parts of the country, though in different proportions. In the province of Lublin, in this study, just one municipality of the first type was distinguished and the dominant category were municipalities representing peripheral areas. There are also visible problematic areas – clusters of municipalities with low and lower than average level of the dynamics of development.

The purpose of this paper is to present the results of the analysis of rural development processes in the Lublin region for the occurrence of convergence or divergence of development based on similarity measures formulated by I. Kudrycka. The article verified the hypothesis about the advancement of the differentiation process of the level of development among the municipalities of the studied region in the reporting period.

The results of analysis will help to identify the characteristics of the differences in developmental processes in the region and will provide an indication to the local authorities, responsible for the design and implementation of intraregional policy for the development of rural areas related to the adaptation of tools to aid the development of the individual needs of the selected groups of areas.

The similarity in the local coordinate system (rural municipalities) was characterized within five areas: human capital, the economy, households, infrastructure and environment. This paper describes the method proposed by I. Kudrycka and presents the analysis of estimated similarity measures and their changes in the years 2004-2007. The basis for determining the similarity measures were BDL GUS data. The similarity measure used in the analysis brought good results of I. Kudrycka while measuring the convergence of regional development in Poland.

2. THE USE OF SIMILARITY MEASURES FOR THE ANALYSIS OF THE CONVERGENCE OF DEVELOPMENT – A DESCRIPTION OF THE METHOD

The basis of the theory of spatial development convergence is the hypothesis of a negative relationship between growth rate and the initial state of development – the higher the initial level of development, the lower the growth rate, and vice versa. This is the so-called β convergence. In contrast to β convergence, there is also σ convergence examined, thus decreasing in time the variance of income (usually GDP between the investigated objects). There are many papers on the verification of the hypothesis of development convergence. Among others, the work of Le Gallo, Ertur, Baumont 2003.

The measure of similarity used in the study of convergence in this paper is a transformed form of inaccurate information that (H. Theil 1961) applied to compare two structures. I. Kudrycka applied similar measures, with good results, in the explanatory variables' selection process in one- and multi- equation econometric models (Kudrycka 1984), and in the process of testing the regions' convergence in Poland (I. Kudrycka 2009, 2010, 2011). In this paper, inaccurate information, is described by the equation:

$$I(Y:X)=\sum_{i=1}^{n} y_i \log\frac{y_i}{x_i}, \tag{1}$$

where: x_i - frequency structure of the ideal pattern in this municipality$_i$ - frequency structure of the present variable in this municipality.

$$\sum_{i=1}^{n} y_i = 1, \quad i = 1, 2, ..., 171. \tag{2}$$

Inaccurate information value $I(Y:X)$ is zero, when $y_i = x_i$ for all i, and $i = 1, ..., 171$ that is appropriate fractions of the two distributions are equal. It is not possible to determine the maximum value $I(Y:X)$, because the value

of the formulation is $y_i \log \frac{y_i}{x_i} \to \infty$, if for fixed x_i we have $y_i \to \infty$. Regulating the measures of inaccurate information according to the formula:

$$P(Y:X) = \frac{1}{1+I(Y:X)}, \tag{3}$$

we get the similarity measure $P(Y:X)$.

In the case of full compliance for structures ($y_i = x_i$) for all and we have $P(Y:X)=1$, and when $I(Y:X) \to \infty$, the discrepancies between the structures are large, and similarity measure $P(Y:X) \to 0$.

It can be, therefore, concluded that the comparison of the distribution by municipalities of the selected variable Y with the distribution of pattern X determined by the municipalities and determining similarity measures $P(Y:X)$ allows us to analyze the distance of this variable from the pattern.

If we, however, define similarity measures in the following units of time (years), then comparing their values will allow us to draw conclusions regarding the presence or absence of convergence.

Approaching the similarity measures to 1, and, thus, obtaining rising similarity measures in successive units of time, testifies the increase in the similarity of the distribution of the test variable to the pattern distribution and indicates the presence of convergence. Similarity measures decreasing in time indicate the occurrence of the opposite phenomenon – divergence.

The advantage of the presented method is that convergence can be analyzed in some aspects, and also because of the different variables, the simplicity of the method, the ability to apply it also in the absence of long-time series and a clear interpretation.

The drawback is to determine an ideal pattern *a priori* of, ideal structure which is the reference point for the distribution of values of variables between the municipalities. Standards should, therefore, be relatively stable over time, because the changes of similarity measures in subsequent units of time (years) are the basis for inference on the presence or absence of convergence of municipalities development, and in the case of changes in distribution patterns, comparisons could not be made over time.

The easiest way to determine the ideal structure of the division is to adopt the distribution of population in relation to variables that characterize human capital, the economy, households and the distribution of the surface as a benchmark for the variables describing infrastructure and the environment.

3. THE ANALYSIS OF THE ESTIMATED SIMILARITY MEASURES AND THEIR CHANGES IN TIME

In this paper, similarity measures were estimated for 19 variables characterizing human capital, the economy, households, infrastructure and the environment. The method formula limited the use of variables that would accept negative and zero values. Data on rural communities of the Lublin region (NUTS 5 level) was obtained from BDL GUS. Time range from 2004 to 2010 was assumed in order to analyze the convergence process after the Polish accession to the European Union. Similarity measures were also calculated for the adopted areas as well as the overall average similarity for all of the areas. Distribution of the size of municipalities is referred to depending on the nature of the variable to the area or to population. (In Table 1 they are marked as A or P).

Table 1. Similarity measures of rural municipalities (2004–2010)

Human capital	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
The population of working age/P	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997
Total number of registered unemployed/P	0.9870	0.9865	0.9822	0.9789	0.9737	0.9794	0.9812
Benefits and assistance in kind and contributions to the pension scheme/P	0.9746	0.9597	–	0.9534	0.9445	0.9456	0.9250
Total number of employees in the main working places/P	0.9130	0.9177	0.9184	0.9194	0.9178	0.9192	0.9136
The average value	0.9686	0.9659	0.9668	0.9629	0.9589	0.9610	0.9549
Economy	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Total revenue of municipal budget/P	0.9967	0.9958	0.9967	0.9968	0.9961	0.9957	0.9763
Entities of the national economy in REGON registry/P	0.9900	0.9892	0.9894	0.9896	0.9889	0.9880	0.9877
National economy entities of the private sector in REGON registry/P	0.9885	0.9874	0.9876	0.9879	0.9872	0.9861	0.9858
Total own revenues of municipal budget/P	0.9702	0.9691	0.9683	0.9682	0.9629	0.9669	0.958
Number of service entities in REGON registry/P	0.9855	0.9843	0.9848	0.9842	0.9832	0.9817	–
Investment capital expenditure/P	0.9356	0.9307	0.9242	0.9218	0.9330	0.92613	0.9417
Infrastructure and the environment	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
The average value	0.9777	0.9761	0.9752	0.9747	0.9752	0.9741	0.9698
Piped water-distribution network of the active length/A	–	0.9291	0.9313	0.9332	0.9361	0.9397	0.9424
Forest land in the municipality/A	0.9131	0.9134	0.9134	0.9143	0.9149	0.9170	0.9180
Spending on municipal economy and the environment in general/P	0.9160	0.8837	0.8605	0.9019	0.9053	0.8866	0.8601
The average value	0.9131	0.9213	0.9223	0.9237	0.9255	0.9284	0.9302
Household	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Dwellings connected to water supply/P	0.9966	0.9966	0.9967	0.9967	0.9965	0.9965	0.9964
Dwellings equipped with bathroom/P	0.9953	0.9953	0.9953	0.9953	0.9951	0.9949	0.9949
Dwellings equipped with a central heating system/P	0.9934	0.9933	0.9933	0.9932	0.9930	0.9929	0.9928

Table 1 (cont.).

Household	2004	2005	2006	2007	2008	2009	2010
Number of dwellings equipped with lavatory/P	0.9943	0.9943	0.9943	0.9943	0.9941	0.9939	0.9939
Housing, the number of dwellings/P	0.9929	0.9907	0.9885	0.9855	0.9818	0.9789	0.9759
The average usable floor space/P	0.9671	0.9667	0.9662	0.9658	0.9655	0.9651	0.9646
The average value	0.9899	0.9895	0.9891	0.9885	0.9877	0.9870	0.9864
The average value in all areas	0.9627	0.9601	0.9582	0.9606	0.9601	0.9591	0.9545

Source: own calculations based on BDL GUS from the years 2004–2010.

The average overall similarity measures included in Table 1 show the occurrence of the process of divergence in the development of rural districts of Lublin province – decrease in the similarity measure of 0.9627 in 2004 to 0.9545 in 2010.

Changes in the similarity measure over time are shown in figures no. 1–5, there are shown the formation of these variables in each of the four analyzed areas of municipal development and the average values of similarity measures for these areas.

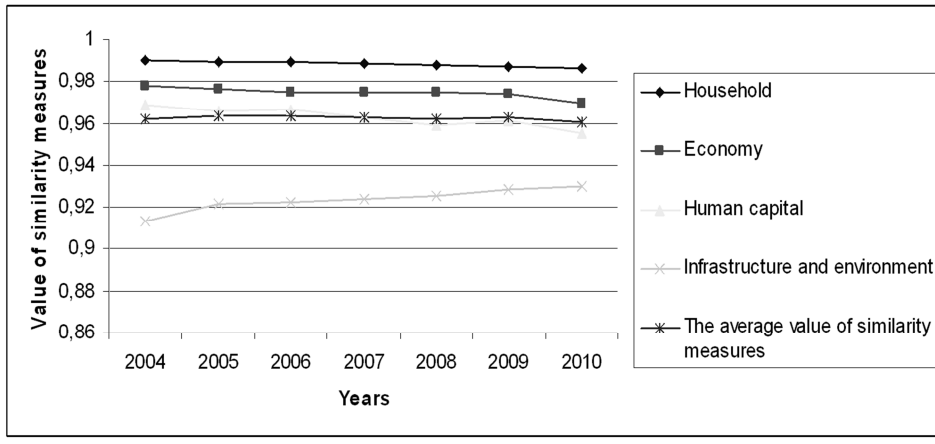

Figure 1. The average values of similarity measures for human capital, the economy, households and the environment between 20042–2010

Source: self-developed.

Household have the highest level of convergence, a bit lower level of convergence occurred in the economy and human capital, the lowest in the area of infrastructure and the environment. In all of the analyzed areas, (with the exception of infrastructure and the environment) slight divergence was noted, however, when analyzing the state for the year 2010, the year 2004 was taken as

an output state. Analysis of the data contained in Figure 1 gives the characteristics of rural development of the Lublin region in the analyzed period: high likeness of rural municipalities in relation to variables describing the functioning of households and the greater diversity and a more explicit process of divergence in other areas, except for the area of infrastructure and the environment.

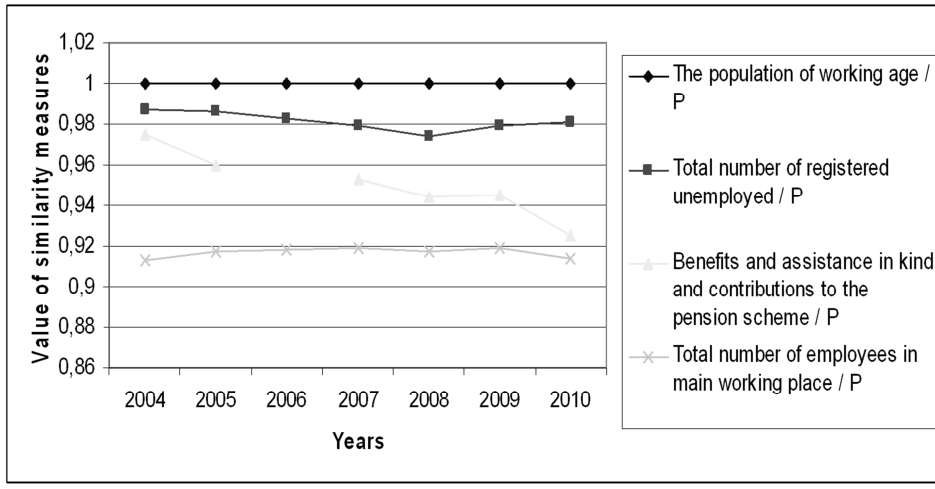

Figure 2. Similarity measures for human capital between 2004–2010

Source: self-developed.

Among the variables describing human capital, the largest convergence occurs in the case of the variables describing the availability of labor force, and in particular, the participation rate of working-age population in total population. The greatest diversity – divergence indicator – occurred while describing the municipal budget expenditures on benefits and assistance in kind and contributions to the pension scheme. This indicator reflects the extent of problems arising from unemployment and poverty of local communities and, in narrower sense, the scale of the needs of local population in this area.

In the area of economy, the biggest divergence concerns the indicators describing the revenue of municipalities' budgets. The stable level of similarity measures concerns indicators describing the saturation of surveyed municipalities with businesses. The indicator of investment expenditure of municipalities' budgets developed unevenly. It should be noted that, in the EU, financial perspectives for 2004–2006 included divergence.

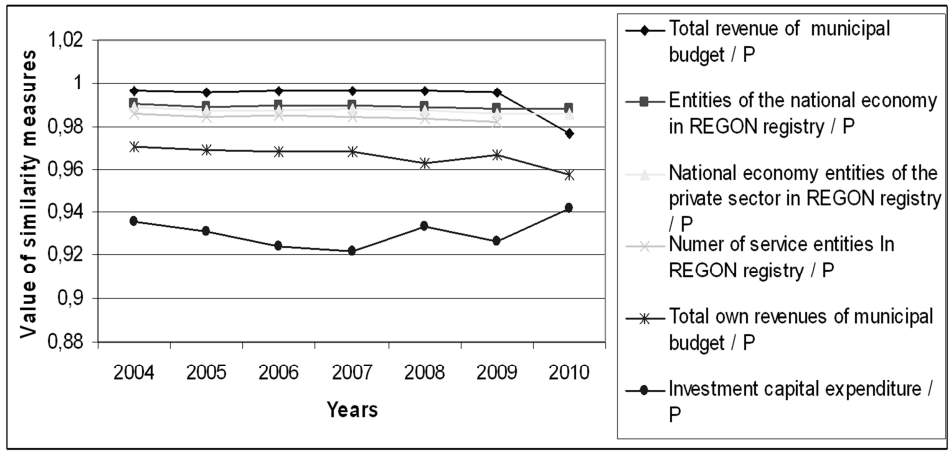

Figure 3. Similarity measures for the economy between 2004–2010

Source: self-developed.

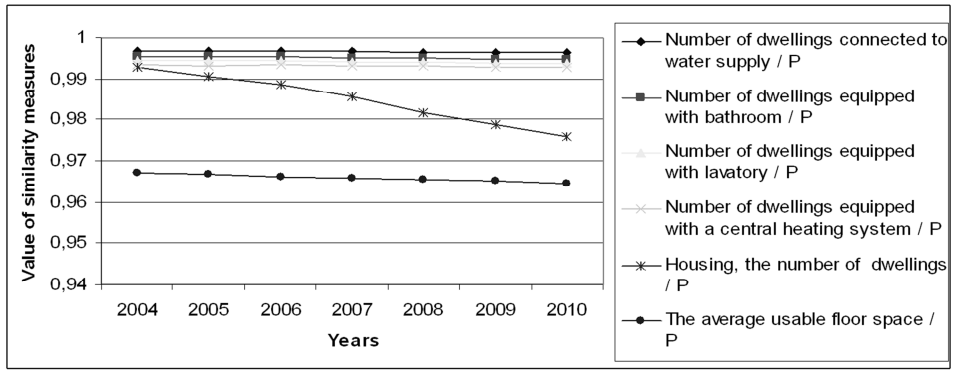

Figure 4. Similarity measures for households between 2004–2010

Source: self-developed.

In the area of households, similar and relatively high, (similarity measure above 0.99) level of convergence is characterized with households equipped with basic utilities (connection to water supply, bathroom, lavatory, and central heating system). Whereas divergence is observed in the availability of housing stock.

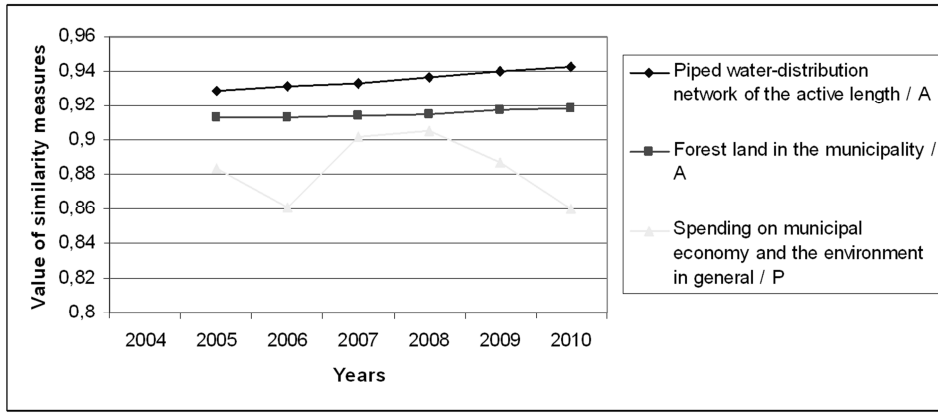

Figure 5. Similarity measures for infrastructure and the environment between 2004–2010

Source: self-development.

In the area of infrastructure and the environment similar level of similarity measures and small convergence is characterized by variables describing water supply and municipal forests. The level of expenditure on public utilities and environmental protection developed unevenly, and after 2007, showed a clear divergence.

4. CONCLUSION

The average overall similarity measures included in Table 1 show the occurrence of the process of divergence in the development of rural districts of the Lublin region – decrease in the similarity measure of 0.962691 in 2004 to 0.954486 in 2010.

Households have the highest level of convergence, a bit lower level of convergence occurred in the economy and human capital, the lowest in the area of infrastructure and the environment. In all of the analyzed areas (with the exception of infrastructure and the environment) slight divergence was noted, however, , when analyzing the state for the year 2010, the year 2004 was taken as an output state.

A detailed analysis of the similarity measure by areas shows the greatest diversity of communities in the areas of:

- infrastructure and the environment – for the municipalities' budgets expenditure on utilities and the environment,
- the economy – property expenditure of municipalities' budgets,
- human capital – the number of employees,
- households – usable floor space.

The study's' results for the rural districts of the Lublin region – the observed process of divergence – are consistent with the results of studies on socio-economic development of rural areas in Poland, conducted by A. Rosner on the increasing discrepancies between the better developed and backward areas.

Rosner's study shows that the consequences of spatial coherence policy, at most, delay the growth of spatial differences – and are not able to reduce them or even maintain the existing level – unequal distribution of resources between developed and backward areas favors the process of divergence and, therefore, there is a need for an active state aid to the underdeveloped communities in collecting their own funding and more efficient targeting of allocation of EU funds within the regions.

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OCENA PROCESÓW ROZWOJU OBSZARÓW WIEJSKICH REGIONU LUBELSKIEGO Z WYKORZYSTANIEM MIAR PODOBIEŃSTWA

Celem referatu jest przedstawienie wyników analizy procesów rozwoju obszarów wiejskich województwa lubelskiego pod kątem występowania konwergencji lub dywergencji rozwoju na podstawie miary podobieństwa sformułowanej przez I. Kudrycką.

Wyniki analizy umożliwią określenie charakterystyki różnic w przebiegu procesów rozwojowych na obszarze regionu oraz stanowić będą wskazanie dla władz samorządowych odpowiedzialnych za projektowanie i realizację polityki intraregionalnej w zakresie rozwoju obszarów wiejskich odnośnie dostosowania narzędzi wspomagania rozwoju do indywidualnych potrzeb wybranych grup obszarów. Podobieństwo w układzie lokalnym (gminy wiejskie) scharakteryzowano w pięciu obszarach: kapitał ludzki, gospodarka, gospodarstwa domowe, infrastruktura i środowisko. W pracy opisano metodę zaproponowaną przez I. Kudrycką oraz dokonano analizy oszacowanych miar podobieństwa i ich zmian w czasie. Podstawą określenia miar podobieństwa były dane BDL GUS.