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SYNTHETIC MEASURE OF RURAL AREA ATTRACTIVENESS FOR LIVING, WORKING AND BUSINESS ACTIVITIES – CONCEPT ANALYSIS AND STATISTICAL EVALUATION

Key words: synthetic measure, economic success, rural areas, socio-economic development

ABSTRACT. The aim of writing the article was to present a concept of constructing a synthetic measure which defines the attractiveness of rural areas as a place to live, work and run business activities. The proposed measure was also empirically verified in the context of time and space. Material comprised data concerning 2,172 rural and urban-rural municipalities, in 2013, 2014 and 2017, following the territorial division of Poland into voivodeships. The data was obtained from the Local Data Bank at the Central Statistical Office (GUS). In the course of the study, for the purpose of constructing the measure, the author used 15 diagnostic variables, describing various functions of rural areas. The variables underwent normalization in order to make them comparable. The author originally chose five methods of normalization and one for further analysis, which caused the smallest dispersion of results. To select it, a variance analysis was conducted. The resulting synthetic measure of rural area attractiveness was verified empirically, in the context of time and space, which confirmed its diagnostic usability and indicated the temporally changeable diversity of Poland's territory, as a system of voivodeships with regard to their attractiveness as places to live, work and run business activities.

INTRODUCTION

The way rural areas are defined and the objective complexity of this definition point to one significant feature they display, i.e. diversity [Saraceno 1994, Halfacree 2006]. It is intensified, if we consider the increasing spatial polarization of countries or regions, which is characteristic of economic development [Grimes 2000, Bański, 2008]. Diversity can be looked upon from different points of view: economic, sociological and geographical [Stanny 2014]. Generally, the diversity of rural areas is reflected in their substantial attractiveness to inhabitants as places where needs regarding living, working or running a business can be met, as discussed further on.

Broadly speaking, the attractiveness of rural areas can be understood as an achievable level of economic success, which subsequently leads to their economic competitiveness [Kamerschen et al. 1992, Thompson, Ward 2005]. In this context, it means the ability of regions to adapt to changing conditions regarding the maintenance or improvement of their position among competing regions. Thus, competitive areas are those where economic

success is achieved, enhancing socio-economic processes, thus resulting in stimulation and continuous development of an area's spatial structure [Bański 2008]. Local authorities, with the ambition to improve the competitiveness of areas administered, must act to increase the region's multifunctionality through the development of infrastructure, care for the natural environment, provision of good quality services, stimulation of entrepreneurship and support of high efficiency of local businesses, as well as inspire social activity of inhabitants. As a result, areas become increasingly attractive to inhabitants with regard to their comfort and standard of living and, in the long run, more and more newcomers are encouraged to settle down permanently in a given place (migration). Considering the tendency towards the depopulation of rural areas, observed for many years, this is a desirable process and involves taking action not only on a local, but also central level [Stasiak 1992, Thompson, Ward 2005, Stockdale 2006, Collantes et al. 2014]. Actions taken in order to reduce the depopulation of urban areas require the proper diagnosis of assets possessed, which may persuade residents to stay or encourage other people to visit or settle down. In the literature on the subject, there are numerous partial indicators examining the fragmentarily described problem (see: Zarębski 2012, Godlewska-Majkowska 2012, Heffner, Klemens 2012), however, they do not refer to the phenomenon of rural area attractiveness in a comprehensive manner. The research carried out aims at filling this gap.

The aim of the paper is to present the concept of constructing a synthetic measure defining the attractiveness of rural areas as a place for living, working and business activities, as well as to empirically verify its reliability in the temporal and spatial context. The analysis concerns Poland, divided into voivodeships, and encompasses the period of 2013-2017. In the course of the study, three main research questions were asked: (1) are rural areas an attractive place to live, (2) are they an attractive place to work, and (3): are they an attractive place to run a business.

MATERIALS AND METHODS

Generally speaking, by comparing individual rural areas, it is possible to establish how attractive they are, and such evaluation much depends on the subjective feeling that the neighbouring area „does better" [Gorzelak et al. 1999]. The attractiveness of rural areas can also be understood as the successful realization of economic undertakings, the outcomes of which contribute to economic development and growth, whether it be socially, economically or environmentally [Sobala-Gwosdz 2004]. As such, it is defined by a number of factors, so it is a complex phenomenon. In economic studies, describing such phenomena involves using so called synthetic measures (indicators), enabling to draw conclusions about the studied phenomenon, described with multiple variables (at least two). In our study, source material was data concerning 2,172 rural and urban-rural municipalities, grouped according to the current administrative division of Poland into voivodeships. Data referred to the years 2013, 2015 and 2017 and were obtained from the Local Data Bank at the Central Statistical Office (GUS).

The research procedure consisted of two stages. The first one involved selecting diagnostic variables, which allowed the author to define the attractiveness of rural areas as a place to live, work and run business activities. The analysis included a total of 15 variables:

X_1 – the number of economic entities per 10,000 people at the production age,
X_2 – the number of unemployed per 10,000 people at the production age,
X_3 – natural attractiveness – the share of legally protected areas within the municipality area,
X_4 – forestation rate (%),
X_5 – population density,
X_6 – kindergartens per 100 km^2,
X_7 – primary schools per 100 km^2,
X_8 – flats per 1000 inhabitants,
X_9 – gas network system per 100 km^2,
X_{10} – sewers system per 100 km^2,
X_{11} – water supply system per 100 km^2,
X_{12} – libraries per 1,000 inhabitants,
X_{13} – total revenue per 1,000 inhabitants,
X_{14} – the share of investment expenses in the total expenditure,
X_{15} – pharmacies per 1,000 inhabitants.

While selecting diagnostic variables, the authors considered factual statistical considerations (the changeability coefficient was at least 10%), as well as the availability of data concerning individual municipalities included in the study.

The next stage involved building a synthetic measure of rural area attractiveness, where the author used the method of no-model measure, which is the arithmetical mean of normalized features:

$$u_i = \frac{1}{p}\sum_{j=1}^{p} z_{ij} \qquad i = 1, \ldots, p$$

where:
u_i – the synthetic measure, p – number of variables, z_{ij} – value of i-observation, j– normalized variable, after changing destimulants into stimulants.

Applying a synthetic measure requires expressing the values of all the variables in the same units, of a similar order of magnitude. The literature on the subject presents various normalization formulas, used in comparative studies of complex economic phenomena [Strahl, Walesiak 1997, Pawełek 2008, Walesiak 2014]. Barbara Pawełek [2008, p. 59] stresses that the choice of the normalization formula has an impact on the final results of analysis. Thus, in order to make variables comparable, the authors chose five methods of normalization and, in their further analysis, used the one which displayed a small dispersion of results. To achieve that, it conducted a variance analysis. The method is the basis for compiling and interpreting a rating list of voivodeships, with respect to rural area attractiveness as a place for living, working and running business activities.

RESEARCH RESULTS

The collected factual material underwent statistical verification, with respect to the changeability coefficient, so that the set of variables could be regarded as diagnostic. The results of the analysis indicated that, in the municipalities included in the study, the data

Table 1. Selected numerical values of diagnostic variables

Diagnostic variables	Numeric data of variables											
	2013				2015				2017			
	mean	median	standard deviation	max	mean	median	standard deviation	max	mean	median	standard deviation	max
X_1	1,126.87	1,146.05	181.90	1,502.73	1,170.59	1,195.43	187.01	1,544.72	1,219.21	1,235.79	195.81	1,603.40
X_2	1,042.24	1,055.45	220.82	1,503.24	770.40	736.45	184.46	1,117.92	551.65	530.12	153.83	827.96
X_3	32.07	30.27	12.25	63.25	32.11	30.28	12.34	63.43	32.07	30.14	12.32	63.46
X_4	27.72	26.52	6.57	46.78	27.83	26.59	6.57	46.86	27.93	26.68	6.57	46.93
X_5	77.61	71.20	40.19	173.90	77.81	71.23	40.54	175.07	78.05	71.42	40.92	176.32
X_6	2.09	1.58	1.60	5.94	2.24	1.67	1.69	6.23	2.38	1.84	1.77	6.48
X_7	3.83	3.50	2.06	8.75	3.81	3.45	2.06	8.79	3.92	3.45	2.12	9.02
X_8	309.08	315.51	22.92	346.72	314.69	320.93	23.96	356.08	320.52	325.83	24.94	365.46
X_9	89.57	82.17	30.37	142.62	92.33	84.38	31.31	147.02	94.23	85.59	32.14	150.52
X_{10}	38.31	32.49	23.98	97.45	44.51	35.80	28.34	103.95	46.58	37.95	29.58	106.10
X_{11}	35.41	19.01	41.79	141.13	36.92	20.56	42.38	144.35	38.44	21.90	43.34	148.02
X_{12}	0.36	0.37	0.06	0.45	0.36	0.37	0.06	0.45	0.36	0.36	0.06	0.45
X_{13}	3,283.22	3,226.04	290.46	4,128.41	3,525.10	3,544.37	253.62	4,026.21	4,409.14	4,420.71	343.27	5,153.70
X_{14}	15.67	16.10	1.66	18.75	15.44	16.49	2.18	18.65	13.44	13.89	1.64	16.13
X_{15}	0.29	0.30	0.03	0.32	0.30	0.31	0.03	0.33	0.31	0.32	0.03	0.35

Source: own study

on the number of flats per 1,000 inhabitants was the least changeable. The highest changeability values concerned the density of the water supply system per 100 km^2.

The object of the study were all Polish voivodeships. Therefore, the next step was to compile data according to the administrative division of the country into voivodeships. Preparing the matrix in this way constituted statistical material for further in-depth analysis. Selected numerical values of diagnostic variables are presented in Table 1.

In a comparative study of complex phenomena occurring while constructing synthetic measures, the normalization of variables is imperative. The main purpose of normalization is to unify the units of variable measures, which ultimately leads to their comparability [Carrino 2016].

In this study, it was assumed that all the variables should be stimulating. Variables X_2 and X_5 were regarded as destimulants, while the remaining ones – as stimulants. The following formula was used for transforming destimulants into stimulants:

$$x_{ij} = \frac{1}{x_{ij}}$$

The result of this transformation was a matrix of output variables x_{ij}, which underwent normalization. Different authors list many other methods of variable normalization [Pawełek 2008, Walesiak 2014], but the most commonly used is standardization. In order to make variables comparable, normalization of variable values was performed, using five normalization formulas (Table 2).

Table 2. Types of variable normalization formulas

Type	Method	Formula
n1	standardization	$z_{ij} = (x_{ij} - \overline{x_j})/s_j$
n2	Weber standardization	$z_{ij} = (x_{ij} - med_j)/1.4826\ mad_j$
n3	quotient transformation	$z_{ij} = x_{ij}/\max x_{ij}$
n4		$z_{ij} = x_{ij}/\overline{x_j}$
n5		$z_{ij} = (x_{ij} - med_j)/\sqrt{\sum_{i=1}^{n}(x_{ij} - med_j)^2}$

Source: own study based on [Walesiak 2014, Jarocka 2015, Kukuła, Luty 2018]

In the final stage of the study, the authors established a ranking of voivodeships according to the values of the synthetic measure of rural area attractiveness in 2013, 2015 and 2017. In order to define the similarity of results, achieved by using specific normalization formulas, the variance analysis was conducted. It showed that the smallest dispersion of obtained values of the synthetic measure occurred when the formula of

quotient transformation, in relation to the maximum value (n3), was used. Similar results were also obtained in the case of applying formula n5. Thus, the results presented further in the article are those obtained with formula n3.

Table 3. Variance analysis value

Rok	n1	n2	n3	n4	n5
2013	0.1007	0.2575	0.0050	0.0389	0.0061
2015	0.0912	0.2285	0.0053	0.0395	0.0055
2017	0.0753	0.1857	0.0052	0.0388	0.0046

Source: own study

While analyzing the results presented in Figure 1, it can be observed that the values of the synthetic measure calculated for individual years were similar. Considering the changeability coefficient value, it ranged from 11.26% in 2013 to 11.56% in 2017. Despite the highest changeability of the synthetic measure value in 2017, the range value was the lowest (0.2289).

In order to define the spatial diversity of voivodeships with respect to the synthetic measure of rural area attractiveness as a place to live, work and run business activities, a ranking was established (Table 4), allocating 1 to the maximum value and 16 to the minimum value.

Taking into account the changes in the rating, it turned out that, from the point of view of studied features (conditions for working, living and running business activity), the most attractive rural areas were found in the Małopolskie and Śląskie voivodeships, and the least attractive in the Warmińsko-mazurskie and Lubelskie voivodeships. It should be stressed that, in 2015, five voivodeships moved one rank up and the Zachodniopomorskie voivodeships dropped by four ranks compared to 2013. In 2017, four voivodeships climbed and six dropped their position in the ranking, compared to 2015.

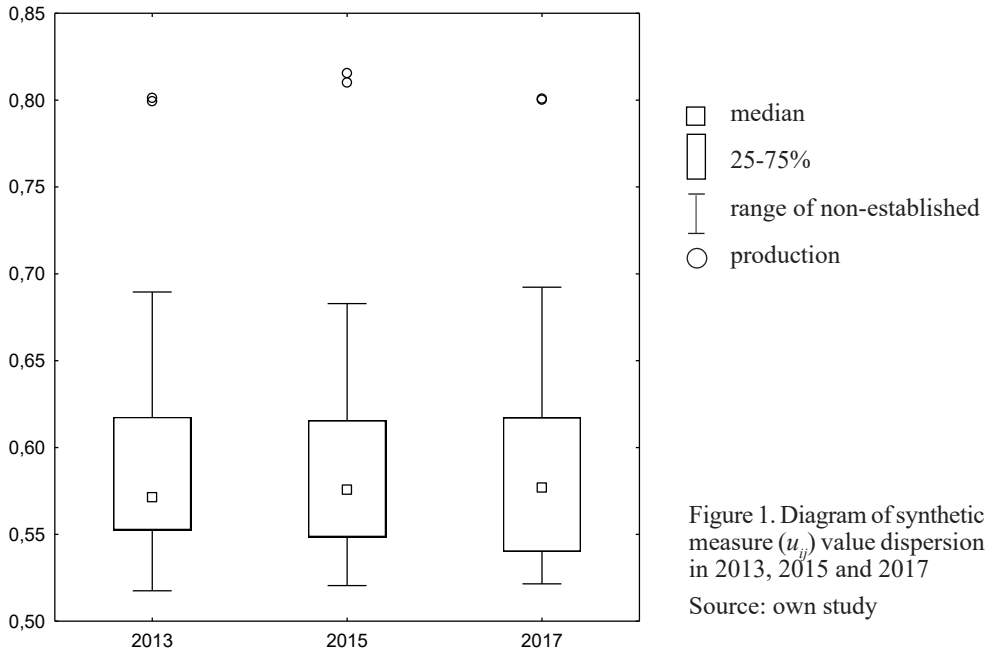

Figure 1. Diagram of synthetic measure (u_{ij}) value dispersion in 2013, 2015 and 2017

Source: own study

In order to establish homogenous groups of voivodeships depending on the synthetic measure, four categories of attractiveness were distinguished based on the arithmetical mean and standard deviation. It should be emphasized that an identical division of voivodeships into four groups was made using the k-means method. The results of the grouping are presented in Figure 2.

The first group, comprising the most attractive areas in 2013 and 2015, consisted of two voivodeships (Małopolskie and Śląskie); in 2017, the group was joined by the Podkarpackie voivodeships. The second group included highly attractive areas. In 2013, it consisted of three voivodeships: Podkarpackie, Świętokrzyskie and Opolskie, and in 2017 – Świętokrzyskie and Wielkopolskie. The remaining voivodeships were included into group III, comprising areas of medium attractiveness. It must be stressed that group IV, comprising areas of low attractiveness, was only distinguished in 2013 and featured the Warmińsko-mazurskie voivodeships. It is also worth mentioning that the Wielkopolskie voivodeships changed its group, moving to group II, consisting of highly attractive rural areas.

Table 4. Voivodeship rating according to the synthetic measure of the rural area attractiveness in 2013, 2015 and 2017

Voivodeships	2013	2015	2017
Dolnośląskie	11	10	11
Kujawsko-pomorskie	14	14	14
Lubelskie	15	15	16
Lubuskie	8	7	6
Łódzkie	10	9	10
Małopolskie	1	1	1
Mazowieckie	7	8	8
Opolskie	5	5	7
Podkarpackie	3	3	3
Podlaskie	13	12	13
Pomorskie	12	11	9
Śląskie	2	2	2
Świętokrzyskie	4	4	5
Warmińsko-mazurskie	16	16	15
Wielkopolskie	6	6	4
Zachodniopomorskie	9	13	12

Source: own study

To answer the research questions posed in the article, analysis was conducted with the use of the Spearman›s coefficient of correlation between diagnostic variables and the synthetic measure value in 2017. The findings included a statistically highly significant

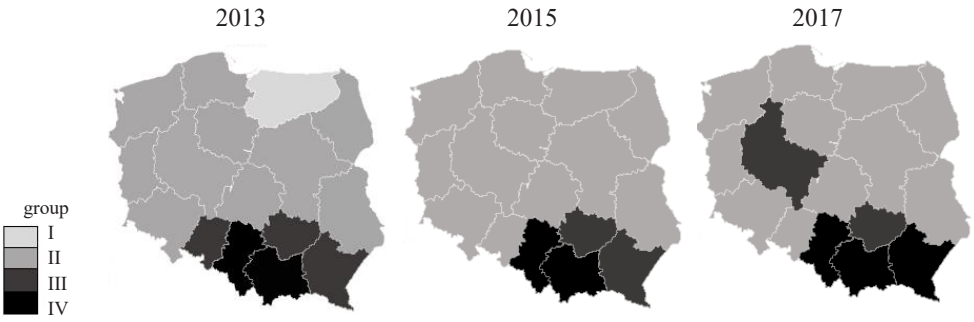

Figure 2. Classification of voivodeships due to the level of the synthetic measure of rural area attractiveness

Source: own study

correlation in the case of variable X_2 – population density ($r_s = 0.80$), and X_6 ($r_s = 0.80$), X_7 ($r_s = 0.77$), X_8 ($r_s = -0.54$). These results confirm the attractiveness of rural areas as a place to live (research question 1). As regards variable X_2 (the number of unemployed), the correlation coefficient value ($r_s = -0.62$) points to a negative correlation of high power (which means that the higher the attractiveness the smaller the number of unemployed – research question 2). Finally, as regards question 2, results indicate a positive correlation of average power ($r_s = 0.34$) between the number of economic entities (X_1) and the synthetic measure, but this correlation was not statistically significant ($p < 0.05$).

CONCLUSIONS

The attractiveness of rural areas against their gradual depopulation is currently acquiring a new dimension. There is a trend to reverse this process for socio-economic reasons, in order to achieve the multifaceted sustainability of national economies. The problem can also be observed in Poland, which justifies research on a synthetic measure, making it possible to objectively diagnose the attractiveness of rural areas as a place to live, work and run business activities, as well as assess this phenomenon in the context of time and space.

The results of the study on the synthetic measure of attractiveness (u_i) confirm the diversity of rural areas with regard to their attractiveness as a place to live, work and run business activity. On the other hand, the results empirically verify the appropriateness of the proposed measure of this attractiveness.

The obtained results confirm the adopted research assumptions. According to the findings, together with the increase in the attractiveness of a given unit, the number of jobs increases, while the number of unemployed decreases.

The deliberations presented in the article fit into the economic theory of regional development [Grosse 2002, Churski 2005], according to which the original cause of the appearance of more competitive areas is regional or local inequality. Although countries try to level out these differences, in economic practice, they become even stronger, and the proposed measure allows us to diagnose them.

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KONCEPCJA BUDOWY SYNTETYCZNEGO MIERNIKA ATRAKCYJNOŚCI OBSZARÓW WIEJSKICH JAKO MIEJSCA DO ŻYCIA, PRACY I DZIAŁALNOŚCI BIZNESOWEJ

Słowa kluczowe: syntetyczny miernik, sukces gospodarczy obszary wiejskie, rozwój społeczno-ekonomiczny

ABSTRAKT

Celem artykułu jest przedstawienie koncepcji konstrukcji miernika określającego atrakcyjność obszarów wiejskich, jako miejsca do życia, pracy i podejmowania aktywności biznesowej. Przeprowadzono także empiryczne sprawdzenie zaproponowanej miary w układzie czasowym i przestrzennym. Materiał wyjściowy stanowiły dane 2172 gmin wiejskich i miejsko-wiejskich za lata 2013, 2015 i 2017, zestawione zgodnie z podziałem terytorialnym Polski na województwa. Źródłem danych był baza Banku Danych Lokalnych GUS. W toku badań do konstrukcji wskaźnika wykorzystano 15 zmiennych diagnostycznych opisujących różne aspekty funkcjonowania obszarów wiejskich. Zmienne te poddano normalizacji w celu doprowadzenia ich do porównywalności. Wybrano pięć metod normalizacji, a do dalszych analiz wybrano tę, którą cechowało mniejsze rozproszenie otrzymanych wyników. Dla jej wyłonienia zastosowano analizę wariancji. Powstały syntetyczny wskaźnika atrakcyjności obszarów wiejskich poddano weryfikacji empirycznej w układzie przestrzennym i czasowym. Uzyskane wynik potwierdziły jego przydatność diagnostyczną, wskazały ponadto na zmienne w czasie zróżnicowanie obszaru Polski w układzie województw pod względem atrakcyjności do życia, pracy i prowadzenia działalności biznesowej.

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