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AN ATTEMPT AT MEASURING THE DEAGRARIANISATION PROCESS OF POLISH RURAL AREAS AT NUTS4 LEVEL

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Abstract: Deagrarianisation is a complex concept, which denotes a declining economic significance of agriculture and agricultural production in society at large, and rural economy and society in particular. The article is an attempt at constructing a composite indicator of the process of deagrarianisation using variables obtained by official statistics. The proposed composite indicator of deagrarianisation is then used to assess the intensity of deagrarianisation of rural areas between 2002 and 2010 in NUTS4 units (Pol. *powiat*) of the province of Wielkopolska.

Keywords: deagrarianisation, rural areas, composite indicator

THE CONCEPT AND DIMENSIONS OFDEAGRARIANISATION

The origin of deagrarianisation processes is closely related to the origin and development of towns and the concentration of inhabitants engaged in non-agricultural activity. These processes seem to be a natural developmental stage of societies, resulting from a kind of competition between the town and the countryside, between agricultural and non-agricultural activity and between the natural and strongly anthropogenic landscape. Nonetheless, many authors focus on negative effects of deagrarianisation. In addition to a diversity of opinions about the very process of deagrarianisation, the literature contains a number of definitions and competing classifications of its aspects. However, they all seem to agree that deagrarianisation is a complex notion, which is why this author believes its measurement and description should draw on multivariate statistical methods.

M. Halamska defines deagrarianisation as a process of decreasing agrarian development, or the declining influence of agriculture on economy, including rural economy and society [Halamska 2011]. She lists the following basic indicators of agrarian development/deagrarianisation:

- the contribution of agriculture to GDP
- the ration of population employed in agriculture to the whole population[1].

M. Halamska also considers two dimensions in which the process of deagrarianisation can be analysed: the subjective dimension, referring to one's social awareness (respondents' declarations concerning their identification with agriculture)and the objective one, which can be determined by a survey of employment in agriculture or income obtained from agriculture.

W. Musiał points out the complexity of the notion of deagrarianisation and considers various attempts at defining it conducted within different areas of knowledge: agriculture and agricultural sciences, economic politics, sociology, economic geography and spatial management, and economics [Musiał 2007]. From the point of view of economics, deagrarianisation can be defined as a historical process of declining importance of agriculture in the national economy, as well as the declining role of agriculture as a source of income for inhabitants of rural areas. W. Musiał presents different approaches to the economic understanding of deagrarianisation: from a microeconomic one, referring to the structure of income and expenditure in rural households, to the regional and environmental approach, to modern aspects of deagrarianisation, such as multi-functionality of rural development, entrepreneurship and diversification of income sources. W. Musiał also describes a synthetic view of deagrarianisation characterised by 4 dimensions:

- production–related (including a decline in the volume of agricultural output, the increasingly common abandonment of agricultural production, institutionalisation and spread of fallowing, a rise in livestock-free farms and a decline in arable land acreage);
- economic (including a declining contribution of agriculture to GNP, a declining contribution of agriculture-related income in rural households, an absolute and relative decline in agricultural employment, a fall in investment in agricultural production);
- social–cultural (including a fall in the number of the rural population engaged in agriculture, increasing social–occupational diversification of the rural population, abandonment of agricultural employment, falling rates of youth education in agricultural occupations, long-term and shuttle economic migration);

[1]It should be pointed out that defining the so-called agrarian character of population may raise doubts as to the choice of a suitable measure (residence with the use of an agricultural holding, possession of an agricultural holding, employment in agriculture, income obtained from employment in an agriculture, etc.).

- ecological and landscape-related (including growing forest cover, a rise in the acreage of fallow land, a rise in the average acreage of arable fields).

J. S. Zegar defines deagrarianisation as a process which accompanies the development of civilisation and involves a decline in the role of agriculture in rural systems [Zegar 2008]. According to the author, the basic indicators of deagrarianisation are:

- demography (changes in the number of people engaged in agriculture);
- job and sources of income (agricultural sources of income);
- natural environment (participation in land management);
- socio-cultural transformations (lifestyle changes, a farmer's work ethos, folk culture).

The author also identifies the agents of deagrarianisation processes, which include: industrialisation, economic mechanisms, globalisation and European integration.

A DESCRIPTION OF THE RESEARCH PROCEDURE AND DATA SOURCES

The definitions and dimensions of the concept of deagrarianisation presented in the previous section confirm its complexity and multidimensional character. The available literature does not mention any attempts at constructing a composite indicator of deagrarianisation. Articles addressing the problem of transformations related to the declining impact of agriculture typically analyse the various aspects of deagrarianisation separately [Halamska 2011].

To fill this gap, the present article is an attempt at developing a composite indicator of deagrarianisation, relying on statistical data from various surveys conducted by official statistics. It should be stressed that the most complete data coverage regarding aspects of deagrarianisation is only possible for census years (the last two agricultural censuses were held in 2002 and 2010). The two censuses offer the largest scope of data and the lowest levels of aggregation, making it possible to obtain certain data at NUTS 5 level (Pol. *gmina*). It should be pointed out, however, that this is possible only with respect to aspects of deagrarianisation related to such units as persons, families, households, farms, buildings and dwellings of people connected with agriculture. In addition to those aspects of deagrarianisation, there are also those, which official statistics cannot provide at NUTS 5 level – for example the contribution of agriculture to GDP.

The research problem presented in this article is therefore to propose a methodology of describing the process of deagrarianisation at the lowest possible level of aggregation and in the inter-census period. It seems that one way of solving the problem is taking advantage of small area statistics methodology, which draws on auxiliary data from sample surveys (such as Labour Force Survey [LFS], Household Budget Survey [HBS], EU-SILC, a survey of farm structure),

agricultural censuses (Agricultural Census 2010) and administrative registers (registered unemployment, social security, residence data, PESEL, POLTAX and others). This is the topic of the author's further work.

To construct a composite indicator of deagrarianisation for *powiats* of the province of Wielkopolska on the basis of data from censuses in 2002 and 2010, a set of potential candidates, consisting of the following variables:

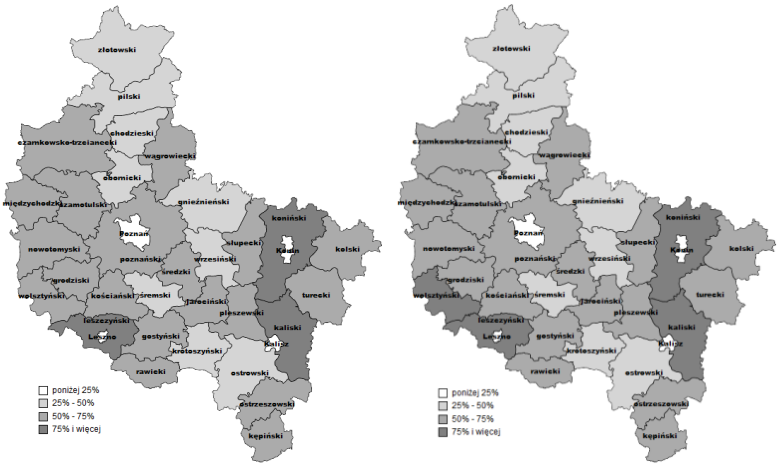
- the percentage of rural population in powiat (X_1),
- the percentage of persons at the pre-productive age residing in a rural area in a powiat (X_2),
- the percentage of population at the productive age residing in a rural area in a powiat (X_3),
- the percentage of population at the post-productive age residing in a rural area in a powiat (X_4),
- the percentage of population residing in a rural area and connected with agriculture in a powiat (X_5),
- the percentage of households in a powiat, which declare income obtained from agricultural activity(X_6),
- the percentage of households in a powiat, which declare income obtained from non-agricultural activity in the powiat (X_7),
- the average acreage of agricultural area in private farms in a powiat (X_8),
- the number of cattle per 100 ha of agricultural area in private farms in a powiat (X_9),
- the number of pigs per 100 ha of agricultural area in private farms in a powiat (X_{10}).

The relevant data come from the Local Data Bank (LDB) published on the website of the Central Statistical Office.

The spatial distribution of selected variables in 2002 and 2010 is presented in Figures 1-3 below[2].

[2] In the figures the cartogram on the left depicts a given phenomenon in 2002 and the one on the right, in 2010.

Figure 1. The percentage of rural population in *powiats* of the province of Wielkopolska in 2002 and 2010



Source: own calculations based on LDB data

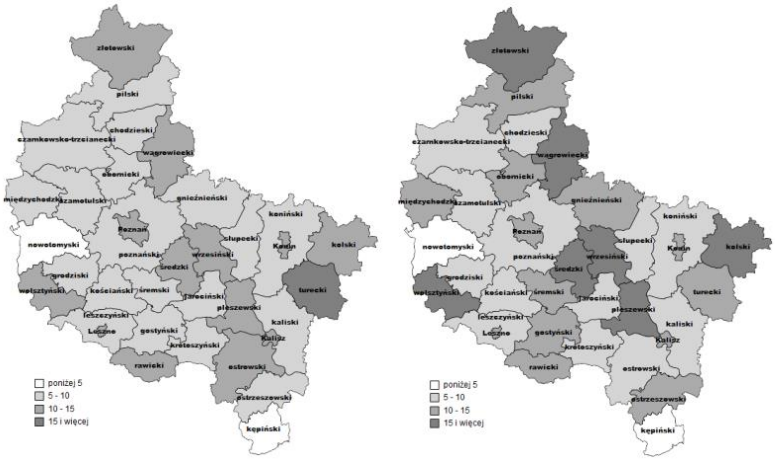
Figure 2. The percentage of population connected with agriculture in rural areas in *powiats* of the province of Wielkopolska in 2002 and 2010

Source: own calculations based on LDB data

The above cartograms (Figs. 1-3) show that the biggest changes between 2002 and 2010 involved the percentage of rural population connected with agriculture. In 2002 in three powiats of Wielkopolska this number exceeded 75% (the powiats of Leszno, Kościan and Grodzisk), while in four powiats it was at the level of 50-75% (the powiats of Złotów, Chodzież, Czarnków-Trzcianka and Międzychód). In contrast, in 2010 not a single exceeded the 50% watermark of rural population

connected with agriculture. This fact reflects very serious changes that took place in rural areas during the inter-census period, changes whose intensity we are not always aware of.

Figure 3. The average acreage of agricultural area (in hectars) cultivated by private farms in *powiats* of Wielkopolska in 2002 and 2010



Source: own calculations based on LDB data

THE STRUCTURE OF A COMPOSITE INDICATOR OF DEAGRARIANISATION

The process of constructing a composite variable in the study consisted of the following stages:

- specifying a set of potential diagnostic variables,
- reducing the vector of potential diagnostic variables,
- differentiating diagnostic variables into stimulants, destimulants and nominants),
- choosing an aggregation formula

During the first stage, the specified set of potential diagnostic variables (variables X_1–X_{10}) was analysed to reduce the vector of potential diagnostic variables. This stage involved:

- eliminating variables with little variation (coefficient of variation < 10%),
- applying a method based on variable orthogonality (analysis of diagonals of an invertible matrix of coefficients of correlation between variables)

Since all the variables display sufficient variation (the coefficient of variation for all the variables exceeded 10%), the method of analyzing diagonals of an invertible

matrix of coefficients of correlation between variables. The results are presented in Tables 1 and 2[3].

Table 1. An analysis of the coefficient of variation for specified diagnostic variables

Variable	Coefficient of variation (%)	
	2002	2010
X_1	46.01	45.57
X_2	44.18	43.79
X_3	46.76	45.74
X_4	46.61	48.04
X_5	69.04	74.48
X_6	43.96	29.68
X_7	47.03	47.90
X_8	32.97	34.45
X_9	46.88	66.04
X_{10}	49.33	107.19

Source: own calculations

To construct a composite indicator of deagrarianisation the following variables were selected: the percentage of population residing in a rural area and connected with agriculture (X5), the percentage of households, which declare income obtained from agricultural activity (X6), the percentage of households, which declare income obtained from non-agricultural activity(X7), the average acreage of agricultural area in private farms (X8), the number of cattle per 100 ha of agricultural area in private farms(X9) and the number of pigs per 100 ha of agricultural area in private farms(X10)[4]. The same set of variables for both target years was characterised by statistical properties that made them suitable to construct the composite indicator. In addition, since all variables (except X7) are destimulants, to ensure that all variables are homogeneous, the X6 variable was converted by means of formulas (1) and (2), for stimulants and destimulants respectively, using the Zero–Unitarisation Method [Kukuła 2000].

Unitarisation for stimulants

$$z_{ij} = \frac{x_{ij} - \min\{x_{ij}\}}{\max\{x_{ij}\} - \min\{x_{ij}\}} \quad (1)$$

[3]Figures shaded grey represent variables whose values on the main diagonal exceeded 10, and hence were regarded as variables, which duplicated information supplied by other variables from the list of potential variables; consequently and they were not used to construct a composite indicator. Variables in cells with bold borders are part of the proposed composite indicator of deagrarianisation.

[4]It should be noted that though there are some arguments for treating the last two variables (X9 and X10)as stimulants with some veto threshold values, determining these threshold values was beyond the scope of the paper.

Unitarisation for destimulants

$$z_{ij} = \frac{\max\{x_{ij}\} - x_{ij}}{\max\{x_{ij}\} - \min\{x_{ij}\}} \quad (2)$$

The arithmetic mean was used as an aggregation formula.

Table 2. An invertible matrix of coefficients of correlation for specified diagnostic variables for 2002

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	653592	-165992	-396051	-92587	-305	54	149	-433	76	96
X_2	-165992	42414	100407	23447	77	-24	-50	108	-18	-26
X_3	-396051	100407	240211	56055	185	-24	-86	264	-46	-56
X_4	-92587	23447	56055	13228	43	-7	-14	61	-12	-13
X_5	-305	77	185	43	2	0	0	0	-1	1
X_6	54	-24	-24	-7	0	2	0	0	0	0
X_7	149	-50	-86	-14	0	0	3	1	0	0
X_8	-433	108	264	61	0	0	1	2	1	-1
X_9	76	-18	-46	-12	-1	0	0	1	3	-3
X_{10}	96	-26	-56	-13	1	0	0	-1	-3	3

Source: own calculations

Table 3. An invertible matrix of coefficients of correlation for specified diagnostic variables in 2010

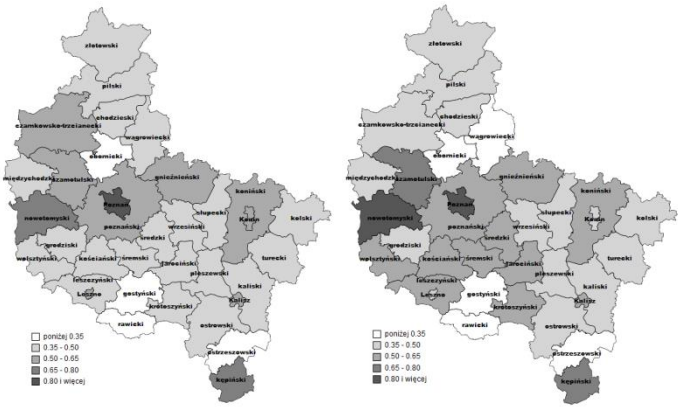
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	315249	-63929	-207637	-43998	-62	63	-1	-125	-86	160
X_2	-63929	13215	41805	8978	16	-13	3	27	13	-24
X_3	-207637	41805	137230	28805	38	-36	0	77	61	-114
X_4	-43998	8978	28805	6261	8	-15	-2	22	14	-22
X_5	-62	16	38	8	1	0	0	0	0	0
X_6	63	-13	-36	-15	0	7	3	-5	-2	-1
X_7	-1	3	0	-2	0	3	3	-2	0	0
X_8	-125	27	77	22	0	-5	-2	4	2	1
X_9	-86	13	61	14	0	-2	0	2	2	0
X_{10}	160	-24	-114	-22	0	-1	0	1	0	2

Source: own calculations

RESULTS OF CLASSIFICATION– CONCLUSIONS

The resulting classification of deagrarianisation is shown in Figure 4.

Figure 4. The spatial distribution of the value of the composite indicator of deagrarianisation in powiats of Wielkopolska in 2002 and 2010



Source: own calculations based on LDB data

The resulting classification of powiats in the province of Wielkopolska in terms of the degree of deagrarianisation shows that the powiat most affected by deagrarianisation processes is the city of Poznań, and, interestingly enough, the powiat of Nowy Tomyśl. In 2010 it is possible to recognise a certain spatial pattern of deagrarianisation processes: namely, powiats situated close to the city of Poznań and in its south-western neighbourhood are less connected with agriculture. On the other hand, powiats located in the south of the province (the powiats of Gostyń, Rawicz and Ostrzeszów, with the exception of Kępno) and north of Poznań (the powiats of Oborniki and Wągrowiec) are still strongly connected with agriculture.

The results of classification provide a good starting point for further work on the analysis of deagrarianisation processes in rural areas. Further stages of research should involve an attempt at estimating of deagrarianisation processes at a similar level of aggregation, during the inter-census period. Particular attention should be paid to data about the demographic structure and processes. The fact that the proposed composite indicator does not account for them should be considered as a deficiency. Another thing worth pointing out is the need to homogenise variables (a clear distinction between the rural and urban parts of powiats) so that the results can refer precisely to rural parts. Unfortunately, these types of cross-classifications are not always available in data provided by official statistics. That is why the author considers it worthwhile to use the methodology of small area statistics in his future studies. The use of information not contained in the sample, relying on the effects of "borrowing strength" in time and space, could provide a solution to the

problem of incomplete data coverage encountered when studying certain complex phenomena. It should also be stressed that the characteristic patterns observed in deagrarianisation processes seem to confirm the need to account for spatial auto-correlation in the analysis of deagrarianisation in rural areas.

REFERENCES

Halamska M. (2001) Transformacja wsi 1989-2009: zmienny rytm modernizacji, Studia regionalne i lokalne, NR 2 (44), s. 5-25.

Kłodziński M. (2010) Główne funkcje polskich obszarów wiejskich z uwzględnieniem dezagraryzacji wsi i pozarolniczej działalności gospodarczej, Studia BAS, NR 4(24), s. 9-28, Warszawa.

Kukuła K. (2000) Metoda unitaryzacji zerowanej, Wydawnictwo Naukowe PWN, Seria Biblioteka ekonometryczna, s. 92-93, Warszawa.

Musiał W. (2007) Dezagraryzacja polskiej wsi – problemy ekonomiczne, ekologiczne i społeczne, Wieś i rolnictwo, NR 3, str. 29-44

Zegar J. S. (2008) Dezagraryzacja wsi : istota i siły sprawcze, referat na konferencji Dezagraryzacja polskiej wsi, Warszawa.