TAXONOMIC ANALYSIS OF AREAL STRUCTURE
OF FARMS IN POLAND WITHIN 2000 - 2007

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Abstract: The paper presents the results of the grouping procedure applied to voivodships in Poland with respect to areal structure of farms in 2000 and 2007. The investigation was based on EU classification of farms and the results compared with areal structure presented in reports of the Central Statistical Office. Dynamics of changes in individual groups was also determined.

Keywords: areal structure of farms, voivodship grouping, level of structural changes.

INTRODUCTION

The paper is the continuation of earlier investigations concerning areal structure of farms in Poland [Bożek 1994, Bożek 2007,], and in particular – its spatial differentiation within the period of 1976-2006 [Bożek 1994, Bożek 2000, Bożek 2008, Kukuła 2005]. The results show that there is a significant differentiation among regions within country area and this seems to be a permanent situation. In 2006 there were 5 groups of voivodships with similar areal structure of farms and high dispersion between groups. [Bożek 2008]. At the same time, one must remember that the research was based on the structure consisting of the following areal intervals:1-2 h, 2-5 h, 5-10 h, 10-15 h, 15-20 h, 20-30 h, 30-50 h, 50-100 h and 100 h and more. Classification of farms in EU terminology is as follows: very small:– up to 5 h, small – 5-10 h, average – small – 10-20 h, average large – 20-30 h, large 30-50 h and very large – above 50 h. One can easily notice that the two structures are different. Because of the fact that the change of structure elements will produce new grouping results [Bożek 1994, Wysocki 1989], the question arises what spatial differentiation of agrarian structure in Poland is like if we take into account farm classification according to the one of EU.

The grouping procedure carried out in the paper concern the data covering the period of 2000 and 2007. The results, obtained as the consequence of application of some chosen taxonomic methods, show regional differentiation of areal structure of Polish agriculture within the period of 2000 – 2006 with its spatial changes and allow for determination of dynamics and direction of changes. They also form the basis for estimation whether the regional differences in areal structure increase or decrease.

INVESTIGATION METHOD

The analysis was conducted on the basis of the data obtained from the Central Statistical Office, concerning the number of farms of the area more than one hectare of arable land in Poland in 2000 and 2007 for voivodships.

The classification of objects (voivodships) into groups of similar structure was carried out by vector elimination method [Chomątowski, Sokołowski, 1978] and then best choice method [Wysocki, Wagner, 1989]. The measure of structures differentiation between the two objects i, j was adopted from Kukuła [Kukuła 1989]:

$$\varepsilon_{ij} = \frac{\sum_{l=1}^{k} \left| a_{il} - a_{jl} \right|}{2} \quad (i,j=1, ..., k;) \tag{1}$$

where a_{il} - share of number of farms from areal group l in the total number of farms in voivodship i.

In order to establish the level of differentiation between typological groups average differentiation measures between groups were calculated [Nowak 1990].

The formula applied to estimate the degree of changes that had taken place within the period from $t - \tau$ to t was as follows: [Kukuła 1989]:

$$v_{t,t-\tau} = \frac{\sum_{k=1}^{r} \left| \alpha_{tk} - \alpha_{(t-\tau)k} \right|}{2} \tag{2}$$

where α is the structure of shares investigated in time $t = 0,1,...,n$, consisting from r elements, i.e.. the matrix is given $\left[\alpha_{tk} \right]_{(t=0,1,...,n;\ k=1,...,r)}$.

The measure (2) takes values from the interval [0;1]. Its high value indicates that the changes that had taken place within the period $t - \tau$ to t are significant. In particular, v_{n0} can be applied to compare the structure from the zero period ($t = 0$) with the structure from the end period ($t = n$).

RESULTS

The average differentiation of areal structure between vovodships in 2000 reached the level of $\beta = 0,2504$ and in 2007 decreased to $\beta = 0,2310$. Application of methods described in previous section to the data from 2007 resulted in classification into four groups of voivodships (table 1), which at the same time means that in Poland in 2007 there were four types of areal structure of farms with significant differences between each two of them. The important fact is that the fourth group consists only from one voivodship - lubelskie.

Table 1. Groups of voivodships with similar areal structure of farms in Poland in 2007.

Voivodship groups	Farms with arable land of the area [in hectares]					
	1-5	5-10	10-20	20-30	30-50	50 and more
	in %					
I łódzkie mazowieckie lubuskie wielkopolskie dolnośląskie opolskie kujawsko-pomorskie pomorskie	47,6	23,9	17,8	5,0	3,3	2,3
II małopolskie śląskie podkarpackie świętokrzyskie	78,5	15,8	4,3	0,8	0,4	0,3
III podlaskie zachodniopomorskie warmińsko-mazurskie	34,5	19,8	24,7	10,0	6,6	4,3
IV Lubelskie	55,6	27,7	12,4	2,5	1,3	0,5
POLAND	57,4	22,2	13,5	3,6	2,1	1,2

Source: Own calulations

This grouping differs from the one carried out for nine element structure, the results of which are shown in table 2 and figure 1. The difference is in group size. However, if we compare composition of groups it turns out that the two grouping have very much in common. In both cases voivodships of south east Poland form one group (II). In both grouping lubelskie voivodship forms one group. The differences concern only three vovodships: zachodnio-pomorskie,

lubuskie and łódzkie. It is a consequence of the fact that these voivodships differ significantly from other voivodships from the groups they belong in grouping of six element structure regarding shares of farms of the area up to 10 hectares and therefore in grouping of nine element structure they are assigned to different groups. Lubuskie and łódzkie voivodships constitute a seperate group (IV) while zachodnio-pomorskie vovodship belongs to the largest – first – group.

Fig. 1. Groups of voivodships of similar areal structure of farms in 2006
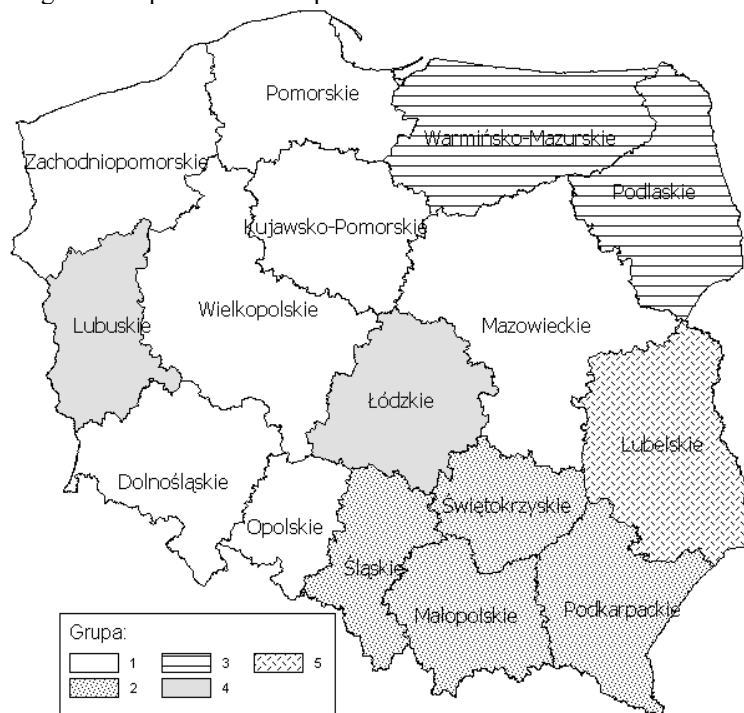
Source: own investigations.

Table 2. Areal structure of farms in distinguished groups of voivodships in Poland in 2006

Voivodship groups	Farms of the area of arable land in hectares								
	1-2	2-5	5-10	10-15	15-20	20-30	30-50	50-100	>100
	W %								
Group I	20,1	25,8	22,6	12,5	6,4	5,7	3,6	2,1	1,2
Group II	34,4	44,1	16,1	3,1	0,9	0,7	0,4	0,2	0,1
Group III	13,0	17,5	21,3	17,2	11,4	10,2	5,9	2,4	0,9
Group IV	14,2	26,3	34,2	14,2	4,6	3,1	1,6	1,3	0,8
Group V	17,7	38,1	28,1	9,2	3,1	2,4	1,0	0,4	0,1

Source: [Bożek 2008]

Another task that should be taken into account is to determine whether the classification is stabile in time. In order to answer this question the grouping procedure was carried out for the data from 2000. It turns out that composition of groups is almost the same as in 2007. The exception is zachodniopomorskie voivodship, that in 2000 was in group I and in 2007 – in group III.

This was the result of significant changes that had taken place in the structure of this voivodship, due to which it became closer the structure of voivodships from group III. Zachodniopomorskie voivodship is the second – with respect to the degree of changes within the period being investigated, which is reflected in the level of measure of structural changes (table 3). The largest changes were observed in lubuskie voivodship (0,113), then zachodniopomorskie (0,088), warmińsko-mazurskie (0,083), podlaskie (0,082) and opolskie (0,076).

Tab.3. Measure of structural changes $v_{2007,2000}$ in individual voivodships

Voivodship	$v_{2007,2000}$
Lubuskie	0,113
Zachodniopomorskie	0,088
Warmińsko-mazurskie	0,083
podlaskie	0,082
Opolskie	0,076
mazowieckie	0,056
Pomorskie	0,054
dolnośląskie	0,052
kujawsko-pomorskie	0,040
łódzkie	0,040
wielkopolskie	0,027
Lubelskie	0,026
świętokrzyskie	0,022
śląskie	0,018
Małopolskie	0,012
podkarpackie	0,011
POLSKA	0,024

Source: [Bożek 2008] and own calculations

According to the definition (2) the coefficients show that the total changes (differences in absolute values) in the structure of these voivodships are oscillating from 22,6 (lubuskie) to 15,2 pp. (opolskie). The lowest rate is observed in case of podkarpackie, małopolskie, śląskie and świętokrzyskie voivodship, where the total changes do not exceed 5 pp. Comparison of structure of groups obtained in

grouping procedure in 2000 and 2007 (table 4) show some trends that are characteristic for agrarian structure in Poland.

Table 4. Areal structure in distinguished groups in 2000 and 2007.

Group		1-5 h	5-10 h	10-20 h	20-30 h	30-50 h	More than 50 h
I	2000	44,6	24,4	20,3	5,8	2,8	2,1
	2007	47,6	23,9	17,8	5	3,3	2,3
II	2000	79,2	16,2	3,5	0,4	0,5	0,2
	2007	78,5	15,8	4,3	0,8	0,4	0,3
III	2000	26,3	22,4	32,5	11,1	5	2,6
	2007	34,5	19,8	24,7	10	6,6	4,3
IV	2000	54,1	29,9	12,8	2,3	0,7	0,2
	2007	55,6	27,7	12,4	2,5	1,3	0,5

Source: own investigations

In group I the share of very small farms increased (from 44,6 to 47,6%) as well as large and very large (in total from 4,9 to 5,6%), while the share of small farms and average farms decreased (from 24,4 to 23,9% in total from 26,1 to 22,8% respectively).

In group II the changes were negligible – small drop of shares of very small and small farms and increase of shares of other areal classes. The largest changes had taken place in group III – significant increase of shares of very small farms (from 26,3 to 34,5%) and large and very large (in total from 7,6 to 10,9%) and decrease in other areal classes.

CONCLUSIONS

1. In Poland in 2007 there were four groups of voivodships with respect to similarity of areal structure of farms (according to EU classification of farms)). Such division maintains from 2000 (except for one voivodship - zachodniopomorskie, which within the period being investigated due to significant changes in structure changed its membership). Therefore, regional differentiation has a permanent character.

2. The largest number of small and very small farms can be observed in the group of south east vovodships, i.e.: małopolskie, śląskie, podkarpackie and świętokrzyskie, where very small farms constitute 78,5% of total number and small farms – 15,8%. Farms of the area above 10 hectares constitute a very small percentage (5,8%). In this group the structure changed very little – there had been very slow decrease of shares of small and very small farms and increase in other areal classes..

3. The lowest number of very smal land small farms occurs in podlaskie, zachodnio-pomorskie and warmińsko-mazurskie voivodship, where they

constitute 34,5% and 19,8% respectively. Average farms compose 34,7% Chile large and very large farms hale shares equal to 10,9%. In this group the rate of changes is at the highest level – significant increase of shares of very small farms (from 26,3 to 34,5%) as well as large and very large farms (in total from 7,6 to 10,9%) and decrease in other areal classes.

4. Other voivodships (except for lubelskie) compose the largest group. These are: łódzkie, mazowieckie, lubuskie, wielkopolskie, dolnośląskie, opolskie, kujawsko-pomorskie i pomorskie. Unlike other groups the percentages of very small and small farms achieve 47,6% and 23,9% respectively. In his group the percentage of average farms is higher than in other groups – 22,8%, while large and very large farms constitute 5,6%. The changes that take place in this group have the same direction as in group III, but the rate of changes is lower.

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Taksonomiczna analiza struktury obszarowej gospodarstw rolnych w Polsce w okresie 2000-2007

Streszczenie: W pracy przedstawiono wyniki grupowania województw ze względu na podobieństwo struktury obszarowej gospodarstw rolnych w roku 2000 i 2007. Przyjęto strukturę zgodną z klasyfikacją gospodarstw w UE i porównano z wynikami dla struktury podawanej w publikacjach GUS. Określono tendencje przemian w wyodrębnionych grupach.

Słowa kluczowe: struktura obszarowa gospodarstw rolnych, grupowanie województw, stopień zmian strukturalnych