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IS THE STRUCTURE OF POLISH AGRICULTURE CHANGING? A COMPARISON BASED ON THE RESULTS OF RECENT GENERAL AGRICULTURAL CENSUSES

Key words: structure of agriculture, gamma convergence, production concentration, concentration of resources, production scale

ABSTRACT. Structural changes in Polish agriculture are necessary. First of all, the scale is expected to increase and, hence, input efficiency. The aim of the research is to determine whether the concentration of resources and production in Polish agriculture is taking place and what is the direction. Data from two general agricultural censuses conducted by the Central Statistical Office in 2010 and 2020 were used. It was determined what main directions of changes were observed in Polish agriculture, as well as whether there is γ-convergence in terms of land resources and the production volume in area groups of farms. For each of the analyzed variables, the importance of farms with an area of more than 20 ha increased. In 2020, they accounted for 11% of the total number of farms. They owned 56% of land and were responsible for 60% of plant production and 70% of livestock production. The share of this group increased by 7 p.p. in land use, but in the sown area (except for cereals), it was an increase of 15 p.p., and in livestock production even up to 20 p.p. For the area groups of farms, a significant γ-type divergence in the use of agricultural land and in the production of cereals, potatoes and field vegetables was confirmed. In animal production, the γ-divergence was only observed in the production of sows and poultry. For other species, there has been a concentration of production, but the ranking of farm groups has not changed. In Poland, in the decade between the agricultural censuses (2010-2020), there was a significant, favorable concentration of agricultural production on farms with a larger area. These changes, however, may be too slow for a significant transformation of Polish agriculture and an increase in its competitiveness in the EU in upcoming decades. The strong fragmentation and low economic strength of farms are still the main limitations.

INTRODUCTION

Structural changes in agriculture are a continuous process and necessary due to technical progress and the expected increase in production efficiency. In recent decades, most EU countries have experienced a continuous process of land concentration and production on economically larger farms. Such a process is desirable because it enables farm development, introducing technological progress, larger farms can form the basis for supporting a farmer's family and generate funds for development investments. In Poland, it is considered important to maintain the importance of family farms in agriculture, with an area of up to 300 ha. In fact, the average area of agricultural land on a farm in 2020 was about 11 ha [GUS 2021]. There is a clear lag in the scope of structural changes in agriculture in Poland and in several other countries of the former Soviet bloc in relation to EU countries (especially the EU-15), which results from systemic transformations [Bański 2017]. This also results in the fact that, although the importance of agriculture in GDP continues to decline, the share in employment remains high [Wicka, Wicki 2016]. In 2020, agriculture in Poland generated 2.4% of GVA, but as much as 14.5% of the economically active worked in it. Thus, labour productivity in agriculture was only 17% of the national average. Without an increase in scale, it will not be possible to increase productivity in agriculture [Gołaś 2019].

DEVELOPMENT POSSIBILITIES OF SMALL AND LARGE FARMS

In 2020, a General Agricultural Census was carried out. This provides an opportunity to assess what changes have taken place in agriculture since the previous census of 2010. In particular, structural changes are expected, leading to the concentration of production on larger farms. Research on structural changes in agriculture indicates the benefits of such changes and their determinants. An important part of the modernization process is the decline in the number of smallest farms, which receive a fairly large share of CAP money. In the EU-15, the number of such farms has decreased by almost half over the last twenty years [Daniłowska 2018]. The number of largest farms has tripled. Larger farms, which use more than half of the EU's cultivated area, account for 80% of the EU's agricultural production [Rovný 2016].

An important reason for reducing the number of small farms in agriculture is that they do not form the basis of a farmer's family income [Grubbström et al. 2014, Hornowski et al. 2020], therefore, they serve rather social functions and are a place of residence [Parzonko 2019]. Often, a low income means that they no longer have development opportunities [Kusz 2018, Bieniek-Majka, Guth 2020], even if they are supported by subsidies, because subsidies only support the income allocated to consumption [Grontkowska

2014, Kanianska et al. 2014, Leimane et al. 2014]. Such farms are also disappearing, as they are of no economic importance to the owners or the economy. Furthermore, there are no successors, as fewer and fewer young people believe that agriculture can provide a certain income and want to take over the management of the farm [Zagata, Sutherland 2015, Rovný 2016]. However, such changes take place over the course of generations, and therefore slowly. Other factors of structural changes include the development of the labour market outside agriculture [Cegielska et al. 2018]. The slowdown in the dynamics of changes in the structure of farms often results from the possibility of obtaining subsidies and allowances; farms near cities perform residential functions [Wojewodzic 2013, Satoła et al. 2018], they can also produce for niche markets within short supply chains [Gruzina, Zvirbule-Berzina 2012, Pölling et al. 2016, Zvirbule et al. 2018, H. Cherevko, I. Cherevko 2020]. Some researchers mistakenly assign important functions related to environmental protection to small farms [Guth et al. 2022]. It can be at most a side effect of the discontinuation of production or its low efficiency, so it is the effect of a lack of production and not the use of pro-environmental production techniques. It is proven that pro-environmental measures are more effectively implemented in larger farms [Derpsch et al. 2016]. Generally, along with the increase in the share of larger farms in agriculture, the productivity of production factors increases. Therefore, it also becomes possible to limit input, while maintaining a given level of production.

The expected structural changes in agriculture and the increasing importance of larger farms result from several premises. In current economic conditions, only large farms are able to generate economic surpluses. They are also characterized by a higher level of productivity [Gołaś 2019, Wicki 2019] and subsidies may have a pro-development function only in economically large farms. In small farms they are a source of financing consumption or ineffective investments [Kusz, Misiak 2017, Bereżnicka et al. 2021].

At the same time, in principle, only large farms have the possibility to effectively use loans, directing them to development [Gruzina, Zvirbule-Berzina 2012, Kata 2018b]. Tadeusz Filipiak and Ludwik Wicki [2021] confirmed that small-area farms must substitute land for labour or capital to remain in the market and an increase in resource productivity can be obtained by substituting factors in a limited scope only. Generally, however, along with an increase in the scale of production, there is a significant increase in productivity, which was confirmed both for farms, agricultural sectors, countries, and also in international comparisons [MacDonald, Newton 2014, Ziętara, Adamski 2014, Fuglie et al. 2021].

The effective production of standard agricultural raw materials can only be carried out on large farms, which can benefit from the support for modernization, but also make more use of technological progress. It is widely confirmed that the increase in production resulted mainly from technological progress, and the consumption of inputs even decreased

[Fuglie 2018, Kata 2018a, Wicki 2021]. In many countries, even if the number of farms does not decrease, production is concentrated in a small part of the largest effectively producing farms [Grubbström et al. 2014]. Such changes are expected both due to the competitiveness of production, a higher input efficiency and also due to the fact that environmentally friendly production technologies can only be effectively implemented in larger farms.

This study attempts to assess whether significant structural changes can be observed in Polish agriculture in the last decade. Data from agricultural censuses 2010 and 2020 were used. They are based on data obtained directly from farms and their results significantly differ from the estimates made in the periods between the censuses. Both the descriptive method and the γ-convergence method were used to determine whether there is a shift in land resources and production between area groups of farms.

Spatial concentration was not taken into account because, as suggested by Lukas Cechura et al. [2014], there was no evidence of catching up with the regions. Expected changes in the structure of agriculture should therefore be observed in the results for the last dozen or so years if we expect an increase in productivity. Hence, it is reasonable to check whether there are structural changes in Polish agriculture, both in terms of resource concentration and production on farms of various sizes.

MATERIAL AND METHODS

The aim of the research is to determine whether, in Polish agriculture in 2010-2020, there were significant structural changes in the concentration of agricultural land and production on farms of various sizes.

The data for the research come from the results of the 2010 and 2020 agricultural censuses to the extent available in November 2021. The analysis covered the utilization of agricultural land, sown area and livestock in groups of farms with various sizes of agricultural land. The census data were aggregated in 11 area groups of farms. Descriptive statistics methods, structure indicators and the γ-convergence method were used. The occurrence of the γ-type divergence indicates that the differentiation (concentration) of resources or production in area groups of farms is increasing.

It was hypothesized that, in the period 2010-2020, there was a significant change in the structures of Polish agriculture. The occurrence of such changes was measured using γ-convergence coefficients (Kendall's Coefficient of Concordance – W).

Since Robert Barro and Xavier Sala-i-Martin [1990] proposed measuring convergence, this method has become very popular in many studies. Convergence is a process of similarity (reducing the differentiation) of examined objects in terms of the value of the variable characterizing the studied phenomenon occurring in these objects. The

opposite of convergence is divergence. Literature [Boyle, McCarthy 1997, Geodecki 2006, Wolszczak-Derlacz 2009] distinguishes: sigma convergence (σ-convergence), beta convergence (β-convergence – absolute and conditional) and gamma convergence (γ-convergence). Gamma convergence was used in the assessment of various economic processes [e.g.,Dittman 2014, Żelazowski 2018, Próchniak 2019]. Convergence is also often used in research in the field of agricultural economics, including national and international comparisons [Dudek 2009, Wicki 2012a, 2012b, Jaroszewska, Pietrzykowski 2017, Baráth, Fertő 2017, Stańko, Mikuła 2018, Twardowska 2019, 2020, Smędzik-Ambroży, Sapa 2020, Akram, Ali 2021].

The phenomenon of γ-convergence occurs when, in the period under examination, compared to the previous period, there is a change in the position of the examined subjects in the ranking prepared on the basis of the value of the variable characterizing the phenomenon under study. When determining the occurrence of γ-convergence, the Kendall *W* rank coefficient of concordance should be used.

Kendall's coefficient of concordance (also known as Kendall's *W*) is a measure of agreement among ranks defined as follows. Assume there are *m* ratings for *k* subjects in rank order from 1 to *k*. Let r_{ij} = the rating in rank *j* gives to subject *i*. For each subject *i*, let $R_i = \sum_{j=1}^{m} r_{ij}$.

There are many alternative notations, but after the transformations one can write *W* as:

$$W = \frac{12S^2}{m^2(k^3 - k)} - \frac{3(k+1)}{k-1}$$

where: $S^2 = \sum_{i=1}^{k} R_i^2$

If all the R_i are the same (i.e., the rankings are in complete agreement), then $W = 0$. In fact, it is always the case that $0 \leq W \leq 1$. If $W = 0$, there is no agreement among rankings.

When $k \geq 5$ or $m > 15$, $m(k-1)W \sim \chi^2 (k-1)$, so one can test the null hypothesis that $W = 0$ (i.e., there is no agreement among rankings – high diversification is observed). In analysis $k = 11$. If the *p-value* is lower than the assumed significance level, then hypothesis about the absence of the rank agreement is to reject. This means that there is no γ-convergence. For example, if one assume that the position of objects in the ranking remains unchanged, the coefficient $W = 1$. However, when the order of objects in the ranking is completely reversed, $W = 0$. In the first scenario, there is a complete lack of convergence (rankings have not changed). In the second scenario, there is full convergence.

It is worth adding that the presence of γ-convergence may be better confirmed when the differentiation of rankings (and the *W* coefficient) decreases in subsequent periods. A regression function can then be used to determine the direction of changes as is usually done for sigma convergence.

W is not a correlation coefficient and so normal estimates of correlation coefficients cannot be used. It turns out, however, that there is a linear transformation of *W* that is a correlation coefficient, namely:

$$r = \frac{mW - 1}{m - 1}$$

In fact, *r* is the average (Spearman) correlation coefficient computed on the ranks of all pairs of value of variables. Alternatively, one can calculate the Spearman correlation coefficient for these rankings [Zaiontz 2021].

For two rankings, one can also use the convergence coefficient in the simplified version (for $n = 2$ rankings, i.e., two periods) [Boyle, McCarthy 1997, p. 259]. The determined value of the *W* coefficient proves the strength of the γ-convergence – the higher the value, the weaker the γ-convergence, and the smaller the value of the coefficient, the stronger the γ-convergence. To verify the hypothesis about the presence of γ-convergence, the previously described statistical test for the Kendall rank concordance coefficient was used.

RESEARCH RESULTS

According to the results of general agricultural censuses in Poland, in the years 2010-2020, the number of farms decreased by 192 thousand (12.7%) from 1,509 to 1,317 thousand farms (Table 1). There were fewer farms in area groups up to 20 ha. It was a decrease by over 10% of farms in each group. The number of farms with an area of 20-100 ha increased by as much as 52%. The average farm area increased by 1.3 ha (13.3%). This signifies a certain concentration of farms, although small farms with an area of up to 7 ha still dominate quantitatively. The share of farms with an area of more than 20 ha increased from 8.4% to 11.2%.

The total land resources in agriculture did not change much, but its concentration increased in farms with an area of more than 20 ha (from 49 to 56%), and the share of land in farms up to 10 ha decreased by 4.5 p.p. up to 25.7% (Table 1). There were significant shifts of land resources between groups of farms, and also the positions of individual groups of farms in the ranking changed, which is indicated by the γ-convergence assessment for land resources (Table 3). There is a significant divergence, which must be equated with

Table 1. Land resources and crop area according to the 2010 and 2020 agricultural censuses in Poland

Farm size group [ha]	Number of farms			Agriculture land		Sown area		Permanent crops		Meadows	
	2010	2020	change [%]	2010	2020	2010	2020	2010	2020	2010	2020
				thousand hectares							
1-2	301	245	-18.6	441	360	218	191	21	17	126	117
2-3	213	179	-16.0	523	437	275	242	23	21	141	133
3-5	276	237	-14.1	1,077	920	629	554	48	45	257	244
5-7	175	146	-16.6	1,036	859	664	563	46	41	216	198
7-10	171	143	-16.4	1,432	1,191	971	816	57	56	274	251
10-15	152	131	-138	1,840	1,591	1,278	1,113	57	62	342	331
15-20	72	65	-9.7	1,240	1,117	871	792	26	31	227	232
20-30	61	62	1.6	1,475	1,488	1,048	1,077	24	27	265	305
30-50	36	44	22.2	1,354	1,672	992	1,253	17	18	223	319
50-100	17	26	52.9	1,165	1,763	879	1,365	23	13	159	305
100+	10	13	30.0	3,259	3,266	2,531	2,767	45	16	345	335
Total	1,509	1,317	-12.9	14,841	14,664	10,357	10,733	387	348	2,574	2,770
Share in area groups of farms [%]											
Up to 10 ha	76.5	73.5	–	30.4	25.7	26.6	22.0	50.4	51.7	39.4	34.0
10-20 ha	15.1	15.2	–	20.8	18.5	20.7	17.7	21.4	26.7	22.1	20.3
Over 20 ha	8.4	11.2	–	48.9	55.8	52.6	60.2	28.2	21.3	38.5	45.6
Change of share of farms over 20 ha [p.p.]	–	2.8	–	–	6.1	–	7.6	–	-6.9	–	7.1

Source: own calculations based on CSO data

the concentration of land in selected area groups at the expense of other groups[1]. However, it should be clearly stated that, according to Eurostat data, only 12% of farms in Poland are classified as large or very large. It is the 21st place among the EU-28.

With regard to the sown area, their concentration increased on farms with an area of more than 20 ha (up to 60%), but no γ-divergence was found. Significant changes occurred in the field of permanent crops and meadows. In the largest farms, the share of permanent crops decreased by 7 p.p. to 21%, while the share of meadows used by these farms increased to 46%. These multidirectional changes were confirmed by the presence of γ-divergence (an increase in differentiation).

There were various trends in plant production. The share of farms up to 10 ha in the sown area decreased significantly, the most in the production of potatoes (by 13.5 p.p.) and field vegetables (12.8 p.p.). The share of other species decreased by about 5 p.p. The exception is rape, the production of which was already highly concentrated (82% of the area in farms over 20 ha). For groups of farms over 20 ha, the share of all species, except for rape, in sowing increased. This means a further concentration of plant production in the largest farms. The largest increase in production concentration in farms over 20 ha was observed for potatoes (17 p.p.), sugar beet (13 p.p.) and field vegetables (17 p.p.). This means that the strongest concentration took place in production intended for highly concentrated processing and for sale to consumers without processing. The assessment of changes is confirmed by the result of the convergence analysis. In the ranking for groups of farms, the groups with the largest area moved to higher positions. A significant divergence was observed for the production of the analysed species – with the exception of rape and sugar beet.

It was subsequently determined whether there was a significant change in the importance of individual area groups of farms in livestock production (Table 2). Only for the sow and poultry herds the presence of γ-divergence was established (Table 3), which in this case means a further concentration of production in farms with the largest area, which in these cases also meant a significant change in the ranking. In cattle production, farms from area groups over 20 ha increased their share in the livestock by 11.5 p.p., for cows it was 15.9 p.p., for pigs in total 16 p.p., and for sows even 19.3 p.p. Importantly, from the point of view of the assessment of production concentration in large farms, farms up to 10 ha saw a decrease in the share of livestock production by an average of 9 p.p. for each species, and on farms with an area of 10-20 ha, a decrease by about 6 (except poultry).

[1] It should be remembered that there may be divergence without changes in the position of groups in the ranking, which may result from small changes or the fact that existing differences between groups are so large that there is no change in the position in a given period. Hence, the presence of γ-convergence alone is not a sufficient condition to determine changes in concentration. However, it complements other analyses.

Table 2. The animal population in area groups of farms in Poland according to the 2010 and 2020 agricultural censuses

Farm size group [ha]	Cattle total		Cows		Pigs total		Sows		Poultry	
	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020
	thousand heads									
1-2	51	36	29	12	118	88	13	5	10,445	9,951
2-3	80	56	43	19	184	104	20	6	10,123	9,401
3-5	224	149	110	52	567	247	61	23	16,557	15,371
5-7	290	206	130	66	790	293	87	23	11,170	10,108
7-10	550	426	240	139	1,457	586	156	48	13,622	12,265
10-15	983	893	438	317	2,264	1,125	221	84	12,257	15,239
15-20	806	780	371	300	1,659	868	155	60	8,766	10,850
20-30	1,011	1,117	479	457	1,969	1,462	176	90	9,918	17,115
30-50	796	1,118	376	467	1,770	1,701	154	106	9,944	14,929
50-100	387	810	179	347	1,347	1,613	101	99	13,876	16,964
100+	551	688	244	293	2,996	2,764	256	241	22,004	31,570
Total	5,728	6,278	2,639	2,468	15,122	10,852	1,400	784	138,682	163,763
Share in area groups of farms [%]										
Up to 10 ha	20.9	13.9	20.9	11.7	20.6	12.1	24.1	13.4	44,6	34.9
10-20 ha	31.2	26.6	30.7	25.0	25.9	18.4	26.8	18.4	15.2	15.9
Over 20 ha	47.9	59.5	48.4	63.3	53.5	69.5	49.1	68.2	40.2	49.2
Change of share of farms over 20 ha [p.p.]	–	11.6	–	14.9	–	16.0	–	19.1	–	9.0

Source: own calculations based on CSO data

Table 3. The results of the γ-convergence analysis for selected variables for groups of farms of different area

Item	Statistical description				Direction of change**
	Kendall *W* coefficient	chi² emp.	*p-value**	correlation r	
Agriculture land	0.9045	18.091	0.0534	**0.8091**	increase in differentiation
Sown area	0.9409	18.818	0.0426	0.8818	no significant changes
Permanent crops	0.9091	17.584	0.0624	**0.6000**	increase in differentiation
Meadows	0.8795	17.587	0.0623	**0.6500**	increase in differentiation
Cereals area	0.9136	18.273	0.0505	**0.8273**	increase in differentiation
Potato area	0.7159	14.314	0.1591	**0.3227**	increase in differentiation
Rapeseed area	0.9966	19.932	0.0299	0.9932	no significant changes
Sugar beet area	0.9739	19.566	0.0336	0.9477	no significant changes
Field vegetables area	0.8023	15.228	0.1240	**0.2773**	increase in differentiation
Total cattle	0.9409	18.818	0.0426	0.8818	no significant changes
Cows	0.9364	18.727	0.0439	0.8727	no significant changes
Pigs total	0.9273	18.545	0.0464	0.8545	no significant changes
Sows	0.8568	17.132	0.0715	**0.6045**	increase in differentiation
Poultry	0.7227	14.455	0.1532	**0.4455**	increase in differentiation

$chi^2_{0.05} = 18.307$, $k = 2$; $m = 11$, df = 10

* H_0 hypothesis is that there is no agreement among rankings – a high diversification is observed between them. If *p-value* > 0.05 there is no reason to reject the H_0 hypothesis – an increase in differentiation is observed; *p-value* > 0.05 is marked in bold for variables, where an increase in differentiation is observed.

** A structure differentiation change; the increase in differentiation means divergence. i.e., changes in the structure between the analysed periods, it also means that there is a concentration in agriculture (see also the shares of bigger farms in table 1 and 2).

Source: own calculations based on CSO data

The assessment of changes in the share of farm area groups in the disposal of land resources and their importance in plant and livestock production, based on the results of the 2010 and 2020 agricultural censuses, showed that Polish agriculture experienced strong concentration processes, both in terms of resources and production. The share of large farms from area groups above 20 ha in land use increased by about 7 p.p. to 56%, in cereal production by 7.3 p.p. up to 56%, in potato production by 17 p.p. up to 50% and in the production of field vegetables by 16.5 p.p. up to 56%. Similar trends took place in livestock production, where the share of this group of farms increased to 60-70% of the total livestock, and the increase was 12-20 p.p. It means that about 11% of all farms are responsible for about 60% of agricultural production. One can risk the statement that the remaining 90% of farms will not survive in the competitive market or will perform limited production functions and, to a greater extent, residential and social functions.

It remains an important issue whether this tendency will be maintained, especially since farms with an area exceeding 30-50 ha are currently considered effective in Poland [Ziętara, Adamski 2014, Wicki 2019], which means that further, relatively quick structural changes are necessary, leading to the concentration of resources and production on farms with an area of more than 50 ha.

CONCLUSIONS

Structural changes in Polish agriculture leading to an increase in the scale of production on farms are still very much needed. Only on larger farms is it possible to introduce technical progress, which leads to an increase in the productivity of factors and, consequently, to a reduction in the impact of agriculture on the environment. Based on the results of the 2010 and 2020 general agricultural censuses, it was determined what changes in the concentration of production in agriculture are observed in Poland. It was found that despite a certain concentration, the scale of production on farms is still small, and in 2020 farms in Poland had an average area of only 11 ha.

It was established that land and production are concentrated on the largest farms, which include those with an area of more than 20 ha. Their share in the total number of farms in 2020 was 11.2%, but their share in the sown area was relatively high, as much as 60%. Their share in the production area of cereals was similarly high, and it was even 80-90% in the production of rape and sugar beet. Similarly high – 60-70% – was their share in the possession of cattle and pigs.

It was found that, in the last decade, the importance of farms with an area of more than 20 ha in plant production increased by about 15 p.p., except for cereals, and in livestock production their share increased by 12-20 p.p. This confirms that the concentration

process is highly dynamic. The significance of changes resulting from the concentration of production was also confirmed with the use of γ-convergence indicators. Changes in the structure of production by groups of farms were much greater than changes in the structure of land owned. It also means that larger farms have much higher factor productivity.

A limitation in the concentration process may be the fact that a large part of small farms plays auxiliary functions for the farmer's families, without generating significant income. Thanks to supporting from subsidies, such farmers can supplement their income and are able to produce some amount of food for self-consumption and sale. In suburban areas, a barrier to change are also high land prices. Another barrier is the still large share of the population working in agriculture, which slows down the processes of structural transformations in agriculture due to the slow replacement of generations on farms.

The hypothesis put forward in the paper was confirmed, albeit in a weak form. On the basis of the conducted assessment, it can be concluded that Polish agriculture is experiencing both rapid processes of land concentration and plant and livestock production concentration. This will be conducive to the expected increase in the scale of production, modernization of agriculture, the introduction of technical progress, and also enable the introduction of environmentally friendly production technologies on a larger scale. Concentration processes should accelerate along with the change of generations of farmers, as the interest in succession in small farms is decreasing. Unfortunately, the process of necessary changes may take another 20 years, so it is difficult to predict whether the delay in relation to other countries will not persist or even increase.

The conducted analysis has several limitations. It should be pointed out here that the assessment was made on the basis of area and livestock data. In addition, the level of efficiency is also important, i.e. productivity of the involved factors of production, which is higher on larger farms. Also, the use of only 10 years in the analysis makes it difficult to assess whether the current changes have similar or higher dynamics than in previous periods. Moreover, due to the scope of the study, the factors that favour or limit concentration processes are widely studied.

BIBLIOGRAPHY

Akram Vaseem, Jabir Ali. 2021. Global disparities of greenhouse gas emissions in agriculture sector: panel club convergence analysis. *Environmental Science and Pollution Research* (28): 55615-22. DOI: 10.1007/s11356-021-14786-6.

Bański Jerzy. 2017. The consequences of changes of ownership for agricultural land use in Central European countries following the collapse of the Eastern Block. *Land Use Policy* 66: 120-130. DOI: 10.1016/j.landusepol.2017.04.045.

Baráth Lajos, Imre Fertő. 2017. Productivity and convergence in European agriculture. *Journal of Agricultural Economics* 68 (1): 228-248. DOI: 10.1111/1477-9552.12157.

Barro Robert, Xavier Sala-i-Martin. 1990. *Economic growth and convergence across the United States.* Working Paper 3419. National Bureau of Economic Research. DOI: 10.3386/w3419.

Bereźnicka Joanna, Ludwik Wicki. 2021. Do operating subsidies increase labour productivity in Polish farms? *Studies in Agricultural Economics* 123 (3): 114-121. DOI: 10.7896/j.2201.

Bieniek-Majka Maryla, Marta Guth. 2020. The dynamics of horticultural farm numbers in different economic size classes and changes in their income in 2007-2017. *Annals PAAAE* XXII (3): 31-41. DOI: 10.5604/01.3001.0014.3626.

Boyle Gerard Eugene, Thomas Gerard McCarthy. 1997. A simple measure of β-convergence. *sxford Bulletin of Economics and Statistics* 59 (2): 257-264. DOI: 10.1111/1468-0084.00063.

Cechura Lukas, Aaron Grau, Heinrich Hockmann, Zdenka Kroupova, Inna Levkovych. 2014. Total factor productivity in European agricultural production. International comparison of product supply chains in the agri-food sector: Determinants of their competitiveness and performance on EU and international markets. *Compete Working Paper* 9: 1-61.

Cegielska Katarzyna, Tomasz Noszczyk, Anita Kukulska, Marta Szylar, Józef Hernik, Robert Dixon-Gough, Sándor Jombach, István Valánszki, Krisztina Filepné Kovács. 2018. Land use and land cover changes in post-socialist countries: Some observations from Hungary and Poland. *Land Use Policy* 78: 1-18. DOI: 10.1016/j.landusepol.2018.06.017.

Cherevko Heorhiy, Iryna Cherevko. 2020. Efficiency of niche agriculture in Ukraine. *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 20 (4): 18-28. DOI: 10.22630/PRS.2020.20.4.19.

Daniłowska Alina. 2018. Changes in European Union farm structure and their multidimensional implications. *Acta Scientiarum Polonorum. Oeconomia* 17 (4): 31-40. DOI: 10.22630/ASPE.2018.17.4.49.

Derpsch Rolf, Dirk Lange, Georg Birbaumer, Ken Moriya. 2016. Why do medium- and large-scale farmers succeed practicing CA and small-scale farmers often do not? Experiences from Paraguay. *International Journal of Agricultural Sustainability* 14 (3): 269-281. DOI: 10.1080/14735903.2015.1095974.

Dittmann Iwona. 2014. Gamma konwergencja cen na lokalnych rynkach mieszkaniowych w Polsce. (Gamma convergence of prices on local housing markets in Poland). *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach* 181: 195-207.

Dudek Hanna. 2009. Konwergencja w zakresie udziałów wydatków na żywność w Polsce – ekonometryczna analiza danych panelowych (Convergence of food share expenditures in Poland – econometric analysis of panel data). *Roczniki Naukowe SERiA* XI (3): 87-91.

Filipiak Tadeusz, Ludwik Wicki. 2021. The structure of production factors in farms and their productivity. The case of vegetable farms in Poland. *Annals PAAAE* XXIII (3): 9-19. DOI: 10.5604/01.3001.0015.2695.

Fuglie Keith, Jeremy Jelliffe, Stephen Morgan. 2021. *Slowing productivity reduces growth in global agricultural output.* USDA, Economic Research Service.

Fuglie Keith. 2018. Is agricultural productivity slowing? *Global Food Security* 17: 73-83. DOI: 10.1016/j.gfs.2018.05.001.

Geodecki Tomasz. 2006. Procesy konwergencji i polaryzacji w regionach Unii Europejskiej (Processes of convergence and polarisation in regions of the European Union). *Zeszyty Naukowe Akademii Ekonomicznej w Krakowie* 714: 75-91.

Gołaś Zbigniew. 2019. Przemiany i uwarunkowania wydajności pracy w rolnictwie Unii Europejskiej w latach 2005-2016 (Changes and conditions of labour productivity in the agriculture of the European Union in the years 2005-2016). *Roczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich* 106 (1): 22-35. DOI: 10.22630/RNR.2019.106.1.2.

Grontkowska Anna. 2014. Znaczenie dopłat w gospodarstwach ogrodniczych w krajach Unii Europejskiej według wielkości ekonomicznej (The importance of subsidies in the EU horticultural farms of different economic sizes). R*oczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich* 101 (3): 66-76.

Grubbström Ann, Susanne Stenbacka, Sofie Joosse. 2014. Balancing family traditions and business: Gendered strategies for achieving future resilience among agricultural students. *Journal of Rural Studies* 35: 152-161. DOI: 10.1016/j.jrurstud.2014.05.003.

Gruzina Zanete, Andra Zvirbule-Berzina. 2012. Support diversification for micro, small and medium size enterprises in Zemgale Region. *Economic Science for Rural Development* 28: 49-55.

GUS (Central Statistical Office – CSO). 2021. *Powszechny Spis Rolny 2020. Raport z wyników* (National Agricultural Census 2020. Report on the results). Warszawa: Central Statistical Office.

Guth Marta, Sebastian Stępień, Katarzyna Smędzik-Ambroży, Anna Matuszczak. 2022. Is small beautiful? Technical efficiency and environmental sustainability of small-scale family farms under the conditions of agricultural policy support. *Journal of Rural Studies* 89: 235-247. DOI: 10.1016/j.jrurstud.2021.11.026.

Hornowski Andrzej, Andrzej Parzonko, Pavel Kotyza, Tomasz Kondraszuk, Piotr Bórawski, Lubos Smutka. 2020. Factors determining the development of small farms in Central and Eastern Poland. *Sustainability* 12 (12): 5095. DOI: 10.3390/su12125095.

Jaroszewska Joanna, Robert Pietrzykowski. 2017. Convergence of the labour productivity in European Union agriculture. *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 17 (4): 120-129. DOI: 10.22630/PRS.2017.17.4.88.

Kanianska Radoslava, Miriam Kizeková, Jozef Novácek, Martin Zeman. 2014. Land-use and land-cover changes in rural areas during different political systems: A case study of Slovakia from 1782 to 2006. *Land Use Policy* 36: 554-566. DOI: 10.1016/j.landusepol.2013.09.018.

Kata Ryszard. 2018a. Agricultural productivity in Poland in the context of structural changes in the sector in 2002-2016. *Economic Sciences for Agribusiness and Rural Economy* 2: 109-115. DOI: 10.22630/ESARE.2018.2.13.

Kata Ryszard. 2018b. Dynamika i struktura zadłużenia kredytowego gospodarstw rolniczych w Polsce (Dynamics and structure of credit commitments of agricultural farms in Poland). *Roczniki Naukowe SERiA* XX (5): 74-80. DOI: 10.5604/01.3001.0012.6684.

Kusz Dariusz, Tomasz Misiak. 2017. Wpływ technicznego uzbrojenia pracy i postępu technicznego na wydajność pracy w rolnictwie (Influence of work technical equipment and technical progress on labour efficiency in agriculture). *Roczniki Naukowe SERiA* XIX (2): 145-150. DOI: 10.5604/01.3001.0010.1177.

Kusz Dariusz. 2018. Level of investment expenditure versus changes in technical labour equipment and labour efficiency in agriculture in Poland. *Economic Sciences for Agribusiness and Rural Economy* 1: 315-320. DOI: 10.22630/ESARE.2018.1.44.

Leimane Ieva, Agnese Krieviņa, Andris Miglavs, 2014. Improving of small farm market capability in Latvia. *Procedia. Social and Behavioral Sciences* 110: 182-189. DOI: 10.1016/j.sbspro.2013.12.861.

MacDonald James, Doris Newton. 2014. *Milk production continues shifting to large-scale farms.* USDA. Economic Research Service.

Parzonko Anna. 2019. Conditions for the development of social farming in the province of Mazovia. *Annals of PAAAE* XXI (4): 366-373. DOI: 10.5604/01.3001.0013.5443.

Pölling Bernd, Wojciech Sroka, Tomasz Wojewodzic. 2016. Strategie i czynniki sukcesu gospodarstw rolnych w wybranych obszarach podmiejskich Europy (Strategies and success factors of farms in selected European peri-urban areas). *Roczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich* 103 (2): 55-68.

Próchniak Mariusz. 2019. Konwergencja beta, sigma i gamma krajów postsocjalistycznych do Europy Zachodniej (Beta, sigma, and gamma convergence of post-socialist countries to Western Europe). *Rocznik Instytutu Europy Środkowo-Wschodniej* 17 (1): 217-243. DOI: 10.36874/RIESW.2019.1.10.

Rovný Patrik. 2016. The Analysis of Farm Population with Respect to Young Farmers in the European Union. *Procedia – Social and Behavioral Sciences* 220: 391-398. DOI: 10.1016/j.sbspro.2016.05.513.

Satoła Łukasz, Tomasz Wojewodzic, Wojciech Sroka. 2018. Barriers to exit encountered by small farms in light of the theory of new institutional economics. *Agricultural Economics* 64 (6): 277-290. DOI: 10.17221/233/2016-AGRICECON.

Smędzik-Ambroży Katarzyna, Agnieszka Sapa. 2020. The impact of agricultural policy on income diversity among farmers in the European Union in 2005–2017. *Nierówności Społeczne a Wzrost Gospodarczy* 63 (3): 195-209. DOI: 10.15584/nsawg.2020.3.9.

Stańko Stanisław, Aneta Mikuła. 2018. Tendencje na rynku masła i serów na świecie i w Polsce w latach 2001-2017 (Tendencies in the global butter and cheese markets in the world and in Poland in the years 2001-2017). *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 18 (4): 437-450. DOI. 10.22630/PRS.2018.18.4.132.

Twardowska Anna. 2019. Konwergencja typu sigma cen gruntów rolnych w państwach Unii Europejskiej (Sigma convergence of agricultural land prices in European Union countries). *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 19 (1): 133-143. DOI: 10.22630/PRS.2019.19.1.12.

Twardowska Anna. 2020. Wyrównywanie się cen gruntów rolnych w krajach Unii Europejskiej (Equalization of agricultural land prices in the European Union countries). *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 20 (1): 67-77. DOI: 10.22630/PRS.2020.20.1.6.

Wicka Aleksandra, Wicki Ludwik. 2016. Bio-economy sector in Poland and its importance in the economy. *Economic Science for Rural Development* (41): 219-228.

Wicki Ludwik. 2012a. Convergence of labour productivity in agriculture in the European Union. *Economic Science for Rural Development* (27): 279-284.

Wicki Ludwik. 2012b. Konwergencja czy dywergencja w zakresie stosowania nasion kwalifikowanych w Polsce (analiza regionalna) (Convergence or divergence in the use of certified seed in Poland. a regional analysis). *Roczniki Naukowe SERiA* XIV (1): 539-544.

Wicki Ludwik. 2019. Size vs effectiveness of agricultural farms. *Annals PAAAE* XXI (2): 285-296. DOI: 10.5604/01.3001.0013.2212.

Wicki Ludwik. 2021. The role of technological progress in agricultural output growth in the NMS upon European Union accession. *Annals PAAAE* XXIII (1): 82-96. DOI: 10.5604/01.3001.0014.7880.

Wojewodzic Tomasz. 2013. Pozorna sukcesja – zaburzenie cyklu życia gospodarstw rolniczych (Delayed succession – disturbance of farm life cycle). *Zeszyty Naukowe SGGW. Ekonomika i Organizacja Gospodarki Żywnościowej* 103: 141-152.

Wolszczak-Derlacz Joanna. 2009. Does migration lead to economic convergence in an enlarged European market? *Bank i Kredyt* 40 (4): 71-87.

Zagata Lukas, Lee-Ann Sutherland. 2015. Deconstructing the "young farmer problem in Europe": Towards a research agenda. *Journal of Rural Studies* 38: 39-51. DOI: 10.1016/j.jrurstud.2015.01.003.

Zaiontz Charles. 2021. *Kendall's coefficient of concordance (W),* https://www.real-statistics.com/reliability/interrater-reliability/kendalls-w/, access: 12.12.2021.

Ziętara Wojciech, Marcin Adamski. 2014. Skala produkcji, efektywność i konkurencyjność polskich gospodarstw wyspecjalizowanych w produkcji mleka (The scale of production, efficiency and competitiveness of Polish farms specialising in milk production). *Zagadnienia Ekonomiki Rolnej* 338 (1): 97-115.

Zvirbule Andra, Aina Dobele, Vineta Pece. 2018. Economic diversification on small agricultural holdings. *Economic Science for Rural Development* 47: 57-64. DOI: 10.22616/ESRD.2018.006.

Żelazowski Konrad. 2018. Konwergencja na regionalnych rynkach mieszkaniowych w Polsce (Convergence in regional housing markets in Poland). *Ekonomia XXI Wieku* 3 (19): 53-64. DOI: 10.15611/e21.2018.3.04.

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CZY STRUKTURA POLSKIEGO ROLNICTWA ZMIENIA SIĘ? PORÓWNANIE NA PODSTAWIE WYNIKÓW OSTATNICH POWSZECHNYCH SPISÓW ROLNYCH

Słowa kluczowe: struktura rolnictwa, gamma konwergencja, koncentracja produkcji, koncentracja zasobów, skala produkcji

ABSTRAKT

Zmiany strukturalne w polskim rolnictwie są konieczne. Przede wszystkim oczekuje się wzrostu skali, a co za tym idzie, także wydajności nakładów. Celem badań było ustalenie czy następuje i jaki ma kierunek koncentracja zasobów i produkcji w polskim rolnictwie. Wykorzystano dane pochodzące z dwóch powszechnych spisów rolnych przeprowadzonych przez GUS w latach 2010 i 2020. Określono, jakie główne kierunki zmian obserwowane są w polskim rolnictwie, a także, czy występuje γ-konwergencja w zakresie zasobów ziemi i wielkości produkcji w grupach obszarowych gospodarstw. W odniesieniu do każdej badanej zmiennej wzrastało znaczenie większych gospodarstw o powierzchni powyżej 20 ha. W 2020 roku stanowiły one 11% gospodarstw, dysponowały 56% ziemi i były odpowiedzialne za 60% produkcji roślinnej oraz 70% produkcji zwierzęcej. Udział tej grupy gospodarstw wzrósł o 7 p.p. w użytkowaniu ziemi, ale już w powierzchni zasiewów (oprócz zbóż) był to wzrost o 15 p.p., a w produkcji zwierzęcej nawet do 20 p.p. Dla grup obszarowych gospodarstw potwierdzono istotną dywergencję typu γ w zakresie użytkowania gruntów rolnych oraz w produkcji zbóż, ziemniaków i warzyw gruntowych. W zakresie produkcji zwierzęcej zmiany obserwowano tylko w pogłowiu loch i drobiu. W okresie między spisami rolnymi nastąpiła korzystna koncentracja produkcji rolniczej w gospodarstwach większych obszarowo. Zmiany te jednak mogą być zbyt powolne, aby w najbliższych dekadach doszło do znaczącej przemiany polskiego rolnictwa i wzrostu jego konkurencyjności w UE. Ograniczeniem pozostaje wciąż silne rozdrobnienie i mała siła ekonomiczna gospodarstw.

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