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SIZE VS EFFECTIVENESS OF AGRICULTURAL FARMS

Key words: farm economic size, effectiveness in agriculture, productivity gap, technological change, agrarian structure

ABSTRACT. The size of farms is one of the most important factors affecting their efficiency. The size of farms affects the ability to invest and introduce technical progress, achieve economies of scale, both internal and external, as well as achieving higher efficiency. The aim of the work is to determine the variation in the effectiveness of production factors and the level of investment depending on the economic size of farms. Data from the Polish FADN database for the years 2010-2017 were used. It was found that along with an increase in economic size, the productivity of production factors increased, productivity in crop and animal production grew and the intensity of reproduction of assets increased. It was found that in farms of the first size class (about 10 ha) were characterized by low efficiency in all assessed aspects and achieved worse dynamics of effectiveness changes. In medium-sized farms (50 ha), a 30-80% higher level of all efficiency indicators was achieved and, in the case of work, efficiency even by 600%. It should be emphasized that farms classified as first class size have no development opportunities because they do not generate a sufficient surplus to provide income for the family and implement investments. The main function of small farms may be its social function and its income may only be an additional source of income for the farmer's family. In order for Polish agriculture to be effective, intensive concentration processes are necessary.

INTRODUCTION

Farming undergoes constant changes under the influence of external and internal factors. These include, most of all, the economic condition of a given country, development of non-agricultural sectors, demand for work, domestic and foreign demand for food, pricing relationships in agriculture, modernity of the agrarian structure, level of income in farming, demand for food and many other factors. In Poland, one of the most significant impulses for change in agriculture in recent years was the common agricultural policy of the European Union, which encompassed Polish farms, including the opening of markets [Stańko 2008, Ziętara 2008, Poczta, Rzeszutko 2012]. On the other hand, this also led to the reinforcement of the unfavorable agrarian structure, and possibilities of development of farming are, in fact, largely dependent upon its structure. In Poland, processes of modernization of agriculture, which have been observed in Western European countries since the 1960s, have not taken place, therefore, the agrarian structure in our country still fails to be a modern one. In 2017, there were more than 1.4 million farms, including 75% having less than 10 ha of arable land, and 52% had less than 5 ha. This means our farm-

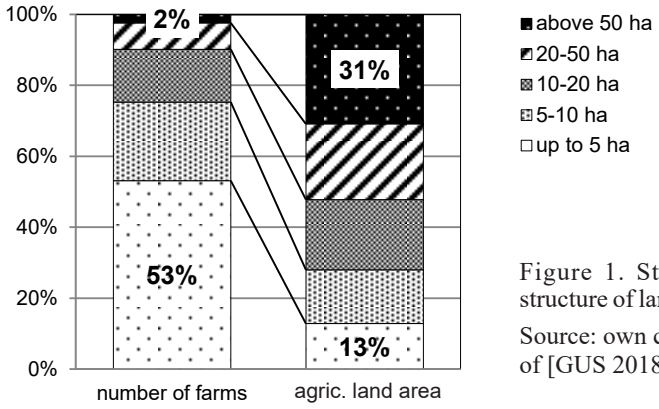

Figure 1. Structure of farms and structure of land use in Poland in 2017

Source: own compilation on the basis of [GUS 2018]

ing is still largely fragmented. Farms below 5 ha occupy as little as 13% of agricultural land, and farms above 20 ha, which constitute around 10% of the total number of farms, occupy 52% of agricultural land (Figure 1). This means that production functions of the smallest farms are performed significantly less effectively in comparison with social, environmental and spatial functions that are indicated as the most significant ones for this group of farms [Hazell et al. 2007, Michalska 2012, Sroka, Musiał 2013, Czekaj, Żmija 2014]. The basic problem of agrarian structure is that small farms, even if their effectiveness is high, are not capable of generating sufficient income for the farmer. Fragmented farming is poor even if effective.

The basic advantages of the improvement of agrarian structure through an increase in farm size are a shift of labor resources from farming to sectors characterized by higher productivity, an increase of labor productivity in agriculture and income per farming employee and an increase of opportunities as well as the need for technological progress [Zegar 2009]. Improvement of the agrarian structure, that is, increasing the share of large and medium-sized farms, next to technological progress, is a prerequisite to achieve an increase in the productiveness of labor and land and the better utilization of input [Kusz et al. 2015, Sobczyński 2013, Wicki 2018]. At large farms, the introduction of technical and technological progress associated with a substitution of labor with capital usually leads to an increase in production, as well as productivity of labor and land, which is necessary to achieve higher income [Gołębiewska 2008]. Because of a higher scale of production, such enterprises are able to engage in intensive and profitable production, also under deteriorating pricing conditions, as a bigger scale offsets a lower margin [Kasztelan 2008, 2009]. At the same time, the level of subsidies per production unit is lower in the case of these farms [Grontkowska 2014].

Many studies have shown that an increase in farm size is associated with numerous advantages, resulting from an increasing scale of operations. An unfavorable agrarian structure is usually associated with low land productivity [Vollrath 2007], although the real strength of this relationship is usually lower than demonstrated due to measurement errors [Desiere, Jolliffe 2018, Carletto et al. 2013]. Should effectiveness of factors of production and the outlay of these factors be similar in all area groups of farms, there would be no strong justification - apart from income per farming employee - to aim at changes in the

agrarian structure. Otherwise, the defective agrarian structure leads to the weakening of competitiveness of Polish agriculture not only in foreign markets, but also in the domestic market, which can be subject to pushing out food of domestic origin [Kraciuk 2018].

Modern agriculture is dependent upon acquisition outlays. These include such factors of production as buildings and equipment, machines and tractors, seeds and varieties, artificial fertilizers, pesticides, but also irrigation systems and information technologies. The introduction of state-of-the-art technical solutions, obviously, is not possible on an optimum scale at family farms due to the size of such farm; nevertheless, better technical solutions can gradually be introduced.

Land concentration offers favorable conditions for the introduction of technical progress. Only biological progress is considered to be more or less neutral for the scale of production, but technological demands of plant varieties and animal races make it reasonable at larger farms [Wicki 2010a,b]. Moreover, when this progress is commercialized by large corporations, its neutrality gradually decreases [Rifkin 2003]. At large farms, investing in progress is both purposeful and possible, as they have sufficient income to co-finance the investment at their disposal [Wysokiński 2011] and make more intensive use of investment subsidies [Kusz 2018, Wicki, Pietrzykowski 2018, Sass 2019]. The experience of Asian countries indicates that it is possible to introduce progress without changing agrarian structure [Harclow 1984, Hayami, Ruttan 1985], but this phenomenon is not reflected in Europe or the USA, as it would require the application of different political instruments [*The Economist* 1996]. As a result, despite the potential increase in land productivity, labor productivity remains low [Kagin et al. 2016, Kusz, Misiak 2017]. At the same time, advantages of land concentration often lead to land grabbing [Zawojska 2014].

Another important issue is labor productivity (effectiveness) achieved by farms of varying sizes. In Poland, low productivity of labor in agriculture is due to its fragmentation, and it is many times lower in comparison with the EU-15 states [Jabłońska et al. 2017, Grontkowska, Wicki 2015, Ziętara 2003], while an increase of labor productivity in agriculture requires structural changes and is progressing slowly [Baer-Nawrocka, Markiewicz 2012, Jaroszewska, Pietrzykowski 2017]. Despite this increase, absolute differences in farm labor productivity between EU member states will keep growing [Wicki 2012]. For instance, for the conditions of Małopolska, it has been determined that the average farm size would have to increase twice in order to let labor at these farms be sufficient to serve as the only source of family income [Basaj 2009], although certain types of small farms also achieve high labor productivity [Mikołajczyk 2011, Filipiak 2017].

Another issue is the possibility of engaging in development investments at farms of varying size. Modernization investments would not be implemented by small farms without subsidies. Only the biggest farms were able to complete some of the investments without support [Babuchowska, Marks-Bielska 2012, Grontkowska 2009, Kirchweger, Kantelhardt 2012, Kusz 2018, Poczta et al. 2012]; however, accessibility of RDP activity is being limited by complex bureaucratic procedures [Papadopoulou et al. 2012, Bórawski, Brodziński 2014]. Without investment, it is not possible to achieve a higher capital-labor ratio and higher income [Czekaj, Satoła 2010, Mickiewicz, Wawrzyniak 2010, Żmija 2018].

According to the extensive data available, effectiveness achieved by farms depends strongly on their size, and only effective and competitive farming has a chance to develop.

MATERIALS AND METHODS

The aim of the work is to describe the variability of effectiveness of factors of production and levels of investment depending on farm economic size. In order to achieve this objective, the following research tasks have been defined: 1) the determination of effectiveness of factors of production, outlays and intensity of investment in farm classes according to their economic size; 2) the determination of dynamics of changes in the effectiveness of farms representing various classes of economic size.

The data analyzed was obtained from the Polish FADN database, from the document SzerCzas-PL-NWAZ-FADN-UE-NORM_20190327.zip. The analysis encompassed the years 2010-2017, as the data for this period has been grouped according to economic size class on the basis of standard output (SO). The measure of productivity of factor of productions was assumed to be gross value added (GVA) per 1 hectare of agricultural land, the annual work unit (AWU) and PLN 1 of value of assets. In the assessment of effectiveness of the production process, the relationship of production to total output was applied, and in the assessment of investment intensity – the relationship of gross investment to depreciation. Technical effectiveness was assessed on the basis of wheat yield and cow milk yield.

Individual effectiveness indicators were calculated on the basis of data in current prices for a given year. The exceptions were technical and economic indicators, that is, land and labor effectiveness measured by GVA. For the purpose of determining these indicators, real gross value added was specified, using, as a deflator, the indicator of gross value added prices in agriculture provided by the Central Statistical Office. Changes of indicator values over time were specified using the exponential function in MS Excel (=ln(regexpp(y_0:y_t;x_0:x_t;1;))). The existence of convergence of effectiveness between farm groups was determined on the basis of sigma convergence specified on the basis of the variability coefficient indicator in years.

The comparison included farms according to their economic size due to the fact that the application of arable size land as the division criterion would make it necessary to conduct analysis separately for each production type. 6 economic size classes were included (in EUR: 1 – very small (2,000-8,000); 2 – small (8,000-25,000); 3 – relatively small (25,000–50,000); 4 – relatively large (50,000-100,000); 5 – large (100,000-500,000); 6 – very large (above 500,000)). The following variables were included in the calculation – SE025, labor – SE010, capital – SE436, GVA – SE410, gross investment – SE516, depreciation – SE360, production value– SE131, outlay value – SE270, wheat yield – SE110, cow milk yield – SE125.

RESEARCH RESULTS

Farms belonging to individual class sizes were diversified. Table 1 presents the key characteristics for farm classes in the years 2015-2017. Items issued in money were entered according to nominal prices. Taking into account the key values, it can be noted that there is a rather strict, but not linear relationship between the size of resources and the economic size class. It is also worth noting that productivity achieved in plant and animal

Table 1. General characteristics of farms according to economic size class

Feature	Economic size class of farms					
	1	2	3	4	5	6
Number of farms	673	4,153	3,770	2,503	1,093	100
Arable land area [ha]	9.3	17.0	31.0	54.4	129.6	907.7
Labor outlays [AWU]	1.21	1.57	1.86	2.08	3.19	24.05
Value of assets [PLN thous.]	370.2	667.7	1,207.7	2,032.5	4,108.1	15,206.8
Production value [PLN thous.]	29.7	75.3	174.2	350.2	990.2	7,182.4
Gross value added [PLN thous.]	19.4	51.5	110.7	200.2	486.5	2,412.4
Annual depreciation [PLN thous.]	9.3	17.8	32.0	53.9	109.5	558.8
Wheat yield [dt/ha]	48.3	53.8	57.6	60.3	63.9	65.9
Cow milk yield [liters]	3,101	4,042	5,147	6,357	7,589	9,270

* GVA – Gross Value Added, AWU – Agriculture Work Unit – work unit in farming, equivalent to one hired worker

Source: own calculations on the basis of data of the Polish FADN

production increased along with farm economic size. Data presented in Table 1 has been used for further calculations in accordance with the aim of the work.

Productivity of factors of production is one of the key determinants of effective farming. Table 2 presents the calculation results, that is, the level, dynamics and variation of indicators analyzed in this study. As can be noted, farms classified as belonging to the first class of economic size are characterized by arable land area similar to the average for all farms in Poland.

The effectiveness of each of the factors of production increased along with economic size of the farm in each of the sub periods examined. Due to the fact that farms of the 6th size class were characterized by area typical for large scale farms, they were not used as a point of reference, indicating only observed differences for key effectiveness indicators. The baseline consisted of farms of the 4th size class, that is, around 50 -hectare areas.

In the years 2010-2013 (the first period), land productivity at the smallest farms constituted around 72% of effectiveness achieved in group 4, and in the years 2014-2017 (the second period), it was around 55%. In the examined period, an increase in variability of land productivity was observed between groups of farms, which indicates the divergence of this indicator. Divergence (variability) of labor and capital productivity indicators increased in a similar manner. Particularly significant differences were observed in terms of labor productivity. In 4th class farms, it was higher by as many as 5 and 6 times in comparison with class 1, in the first and second period, respectively. In 4th class farms, the GVA value per worker amounted to PLN 134 thousand, while in 1st class farms, it was PLN 22 thousand. Income per capita amounted to PLN 8 thousand and 70 thousand, respectively.

Slightly lesser differences were recorded with regard to capital productivity. In the 1st size class, it was PLN 141 GVA/1,000 PLN in assets in the first period and as little as PLN 52 GVA/1,000 PLN in assets in the second period. This corresponded with only 73%

Table 2. Effectiveness indicators for farms according to economic size class

Economic size class	Average area in hectares	Effectiveness indicator						
		GVA*/ ha	GVA/ AWU#	GVA/ assets	produ-ction/ outlays	gross invest-ment/ depre-ciation	wheat yield	cow milk yield
	Average in the years 2010-2013							
1	9.6	3,627	25,394	0.14	1.13	0.23	42.0	3,164
2	19.0	4,270	46,128	0.17	1.24	0.82	47.2	3,991
3	36.0	4,635	83,248	0.18	1.30	1.41	51.6	5,027
4	59.0	5,056	127,672	0.19	1.30	1.85	54.1	6,081
5	143.2	5,048	167,362	0.22	1.20	1.98	56.9	6,937
6	1,009.4	3,897	130,128	0.22	0.98	1.48	59.2	8,391
	Average in the years 2014-2017							
1	8.9	3,009	22,059	0.05	0.95	0.07	48.5	3,145
2	16.9	4,210	45,058	0.08	1.09	0.53	54.3	4,028
3	30.9	5,000	82,330	0.09	1.19	0.91	58.6	5,101
4	52.5	5,422	134,713	0.10	1.22	1.20	61.4	6,302
5	129.6	5,367	211,004	0.12	1.18	1.41	65.1	7,446
6	906.2	3,827	410,407	0.16	0.95	1.26	68.3	9,145
	Average annual dynamics of indicator change in the years 2010-2017 [%]							
1	–	-2.29	-1.24	-20.03	-3.86	-53.11	2.80	-0.27
2	–	1.93	1.73	-15.58	-2.65	-7.94	2.65	0.37
3	–	4.18	2.17	-13.35	-1.63	-9.49	2.35	0.46
4	–	4.03	3.71	-12.87	-1.10	-8.88	2.41	1.06
5	–	3.95	7.38	-11.82	-0.21	-6.95	2.53	1.95
6	–	2.33	14.01	-6.49	-0.55	-8.65	2.43	2.12

* GVA – Gross Value Added, AWU – Agriculture Work Unit – work unit in farming, equivalent to one hired worker

Source: own arithmetic on the basis of data of the Polish FADN

and 53% of the indicator level recorded for 4th size class farms. The indicator dropped for all size classes, but the dynamics of change decreased along with the increase in economic size (Table 2). For 1st class farms, the indicator decreased by 20% annually, and for 4th class farms – by 13% annually.

The efficiency of transformation of outlays into effects was assessed in terms of the relationship between value of production and value of outlays. In four size classes, this indicator was above 1, which means production was effective. Only for the biggest and smallest farms, representing the 1st and 6th size class, this indicator amounted to 0.95 in the second period, which means that these farms generated no production surplus, and

income was earned thanks to subsidies received. Comparing the effectiveness of production at farms from other size classes, it can be noted that the indicator of effectiveness of transformation of input improved systematically along with economic size. In class 4, treated as the baseline, it was higher by 15% and 29%, respectively, in comparison with class 1. The results obtained lead to the conclusion that at present, production cannot be managed effectively by the smallest farms. The same applies to farms of the largest economic size.

A significant aspect of farm durability is its ability to develop. It was measured using the gross investment to depreciation ratio. In the first period, in the first two size classes, this indicator was below 1, which means such farms were unable to ensure simple reproduction in the long-term. In the second period analyzed, the same situation was recorded in the first three economic classes (farms of an area below 30 hectares). The highest asset renewal indicator was recorded by farms of the 5th class of size. Taking into account the span of this indicator, value between the examined farm classes, it should be stated that at farms belonging to the fourth class of economic size, the asset renewal indicator in the second period was many times higher in comparison with group 1, and in relation to farms of the 2nd size class, it was 2.3 times higher in each of the sub-periods.

The last two of the effectiveness indicators compared are wheat yield and cow milk yield. These are technical indicators, which are less dependent on current pricing ratios, and at the same indicate the modernity of production technology. Wheat yield increased along with the increase in farm economic size. In both periods, the differences reached 40%, and the span – 20 dt/ha. In the case of farms representing the 4th economic size class, wheat yield was approximately 30% higher in comparison with the smallest farms. Even greater differences were observed with regard to cow milk yield. The span reached as much as 6000 liters per cow between the smallest and biggest farms. In the case of farms of the 4th economic size class, cow milk yield was about twice as high as achieved by farms of the 1st size class.

Summarizing the differences in yield achieved by farms of varying size, it should be indicated that an improvement in each of the indicators examined followed the increase in farm economic size. The most significant differences were observed in terms of labor productivity, the asset replacement indicator and cow milk yield. Lesser, but still significant differences, reaching the level of 80%, were recorded with regard to land and capital productivity; the differences were smallest in terms of effectiveness of the production process and plant production. It is worth noting that, at the biggest farms, income was dependent on subsidies received.

The dynamics of changes in productivity indicators (Table 2) varied. Capital productivity, the effectiveness of the production process and the asset replacement indicator deteriorated, while the remaining indicators increased gradually. At farms belonging to higher economic size classes, higher dynamics of increase and lower dynamics of decrease in the indicator value were observed, which means that the productivity gap between small and large farms is persistent and growing. It should be noted that divergence was observed in relation to all of the indicators analyzed. In the subsequent years, the variability coefficient for these values increased.

SUMMARY

It is generally known that smaller farms cannot take full advantage of development and production modernization opportunities due to many economic and technical limitations. Nevertheless, they should play an important role in the economy due to their social and environmental functions. In this study, an attempt was made to determine the significance of these farms in agriculture and productivity gaps between them and farms of medium economic size. It was found that the significance of farms classified as belonging to the 1st class of economic size, that is, up to around 10 hectares, is low in agriculture. In total, they constitute as many as 75% of all farms in Poland, using only 28% of agricultural land. Their share in production is even lower due to lower land productivity.

As the economic size of the farm increases, so does effectiveness of production. This applies to productivity of factors of production, effectiveness of the production process, the asset replacement ratio, as well as yield achieved in plant and animal production. At farms of an approximate size of 50 hectares, animal and plant production effectiveness and land and capital productivity were higher by about 30-80% in comparison with 10 hectare farms. The most significant differences were observed in relation to labor productivity, which was as much as six times higher between the groups of farms mentioned above. Labor productivity at small farms remains low, failing to provide sufficient income for the family, or even a single person.

The productivity gaps recorded increased over time, which was due to higher dynamics of increase in productivity at medium-sized and large farms in comparison with small ones. Taking into account these findings, it can be stated that, on average, farms of up to 20 hectares in size, in particular those not more than 10 hectares in size have no development perspectives due to their inability to generate income sufficient for those working on the farm to make a living and engage in development-related investments. They may only serve as an additional source of family income, provide food for the owners and the local community. In their domination regions, they may play important social functions and contribute to maintaining vitality of rural areas. Legal and economic support aimed at development, however, should focus on farms of greater economic size, including support in the process of expansion of their area.

BIBILOGRAPHY

Babuchowska Karolina, Renata Marks-Bielska. 2012. Unowocześnianie gospodarstw rolnych z województwa warmińsko-mazurskiego w ramach PROW 2007-2013 (Modernization of Farms from the Warminsko-Mazurski Region under the RDP 2007-2013). *Zeszyty Naukowe SGGW, Polityki Europejskie, Finanse i Marketing* 8 (57): 36-46.

Baer-Nawrocka Agnieszka, Natalia Markiewicz. 2012. Procesy konwergencji/dywergencji w zakresie wydajności pracy w rolnictwie Unii Europejskiej – analiza regionalna (Processes of Convergence/Divergence of Labour Productivity in Agriculture of the European Union – Regional Analysis). *Journal of Agribusiness and Rural Development* 3 (25): 13-23.

Basaj Maciej. 2009. Skala przeludnienia agrarnego w rolnictwie Małopolski (The scale of agrarian overpopulation in agriculture in Malopolska province). *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu* 11 (4): 20-24.

Bórawski Piotr, Zbigniew Brodziński. 2014. Wykorzystanie wsparcia finansowego z Unii Europejskiej w gospodarstwach mlecznych w opinii ich właścicieli (The use of the financial support from the European Union by the dairy farm owners). *Roczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich* 101 (1): 127-136.

Carletto Callogero, Sara Savastano, Alberto Zezza. 2013. Fact or artifact: The impact of measurement errors on the farm size – productivity relationship. *Journal of Development Economics* 103: 254-261.

Czekaj Marta, Łukasz Satoła. 2010. Szanse i bariery rozwoju produkcji mleka w Małopolsce w opinii rolników (The farmers' opinions about possibilities and barriers of milk production in Malopolska region). *Zeszyty Naukowe SGGW. Ekonomika i Organizacja Gospodarki Żywnościowej* 84: 63-75.

Czekaj Marta, Janusz Żmija. 2014. Społeczny charakter drobnych gospodarstw rolnych (Social meaning of small agricultural holdings). *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 14 (2): 269-278.

Desiere Sam, Dean Jolliffe. 2018. Land productivity and plot size: Is measurement error driving the inverse relationship? *Journal of Development Economics* 130: 84-98. DOI: 10.1016/j.jdeveco.2017.10.002.

Filipiak Tadeusz. 2017. Produktywność czynników produkcji w gospodarstwach ogrodniczych w Polsce w latach 2004-2014 (Productivity of production factors in horticultural farms in Poland in the years 2004-2014). *Roczniki Naukowe SERiA* XIX (6): 79-85. DOI: 10.5604/01.3001.0010.7905.

Gołębiewska Barbara. 2008. Zróżnicowanie wykorzystania zasobów produkcyjnych w rolnictwie krajów UE (Differentiation of use of production factors in agriculture in the EU countries). *Roczniki Naukowe SERiA* X (1): 91-96.

Grontkowska Anna, Ludwik Wicki. 2015. Zmiany znaczenia agrobiznesu w gospodarce i w jego wewnętrznej strukturze (Changes to the importance of agribusiness in the economy and its internal structure). *Roczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich* 102 (3): 20-32.

Grontkowska Anna. 2009. Znaczenie dopłat w gospodarstwach o dużej i bardzo dużej sile ekonomicznej w krajach Unii Europejskiej w latach 2004-2006 (Significance of direct payments for the EU farms characterised by an economic size over 40 ESU in the years 2004-2006). *Roczniki Naukowe SERiA* XI (1): 123-129.

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). *Roczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich* 101 (3): 66-76.

GUS (Central Statistical Office – CSO). 2018. *Użytkowanie gruntów i powierzchnia zasiewów w 2018 r.* (Land use and sown area in 2018). Warszawa: GUS.

Harclow Harold.1984. Agricultural policy analysis. American Journal of Agricultural Economics 68 (3): 755-756.

Hayami Yujiro, Vernon Ruttan. 1985. *Agricultural development: an international perspective.* Baltimore and London: The John Hopkins University Press.

Hazell Peter, Collin Poulton, Steve Wiggins, Andrew Dorward. 2007. The future of small farms for poverty reduction growth. [In] *2020 Discussion Paper 42*. International Food Policy Research Institute, Washington. DOI: 10.2499/97808962976472020vp42.

Jabłońska Lilianna, Lidia Gunerka, Tadeusz Filipiak. 2017. Efektywn.ość ekonomiczna gospodarstw ogrodniczych w wybranych krajach Unii Europejskiej (The economic efficiency of horticultural crops in selected European Union countries). *Roczniki Naukowe SERiA* XIX (2):77-82. DOI: 10.5604/01.3001.0010.1162.

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

Kagin Justin, Edward Taylor, Antonio Yúnez-Naude. 2016. Inverse productivity or inverse efficiency? Evidence from Mexico. *The Journal of Development Studies* 52 (3): 396-411.

Kasztelan Paweł. 2008. Intensywność produkcji a efektywność ekonomiczna wielkoobszarowych przedsiębiorstw rolniczych (Production intensity and economic efficiency of large agricultural enterprises). *Roczniki Nauk Rolniczych. Seria G* 95 (1): 85-94.

Kasztelan Paweł. 2009. Substytucja czynników produkcji w wielkoobszarowych przedsiębiorstwach rolniczych (Substitution of production factors in the large scale agricultural companies). *Roczniki Nauk Rolniczych. Seria G* 96 (3): 174-181.

Kirchweger Stefan, Jochen Kantelhardt. 2012. *Improving farm competitiveness through farm-investment support: a propensity score matching approach.* [In] 131st EAAE seminar in Prague, 18th and 19th September 2012, http://ageconsearch.umn.edu/handle/135791.

Kraciuk Jakub. 2018. Bezpieczeństwo żywnościowe Polski na tle wybranych krajów Europy Wschodniej (Food security in the selected countries of Eastern Europe). *Zeszyty Naukowe SGGW. Ekonomika i Organizacja Gospodarki Zywnościowej* 121: 41-53. DOI: 10.22630/EIOGZ.2018.121.3.

Kusz Dariusz. 2018. *Pomoc publiczna a proces modernizacji rolnictwa* (Public aid and the process of agriculture modernization). Rzeszów: Oficyna Wydawnicza Politechniki Rzeszowskiej.

Kusz Dariusz, Stanisław Gędek, Ryszard Kata. 2015. Egzogeniczne uwarunkowania inwestycji w rolnictwie polskim. [In] *Problemy rozwoju rolnictwa i gospodarki żywnościowej w pierwszej dekadzie członkostwa Polski w Unii Europejskiej* (Exogenous determinants of investment in Polish agriculture. [In] Problems of agriculture development and food economy in the first decade of Poland's membership in the European Union). Warszawa: Polskie Towarzystwo Ekonomiczne.

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 labour on efficiency in agriculture). *Roczniki Naukowe SERiA* XIX (2): 145-150. DOI: 10.5604/01.3001.0010.1177.

Michalska Sylwia. 2012. Społeczny wymiar funkcjonowania drobnych gospodarstw rolnych (Social aspects of the functioning of small farms). *Problemy Drobnych Gospodarstw Rolnych* 1: 85-93.

Mickiewicz Antoni, Bogdan Wawrzyniak. 2010. Przebieg i realizacja działania „Modernizacja gospodarstw rolnych" w ramach PROW na lata 2007-2013 (Process and realisation of measure "Modernisation of agricultural farms" in the frame of Rural Development Programme for 2007-2013 (RDP). *Zeszyty Naukowe SGGW. Ekonomika i Organizacja Gospodarki Żywnościowej* 86: 55-67.

Mikołajczyk Jarosław. 2011. Wydajność pracy w towarowych gospodarstwach rolnych wg typów rolniczych i regionów (Labour productivity on commercial farms according to agricultural types and FADN regions). *Roczniki Naukowe SERiA* XIII (3): 193-198.

Papadopoulou Eleni, Christos Papalexiou, Nikolaos Hasanagas. 2012. Participatory evaluation of rural development programmes: A qualitative approach in the case of modernisation of agricultural holdings in Greece. *Regional Science Inquiry Journal* IV (1): 81-94.

Poczta Walenty, Anna Rzeszutko. 2012. Rozwój rolnictwa w Polsce w warunkach Wspólnej Polityki Rolnej (The development of agriculture in Poland in terms of Common Agricultural Policy). *Zeszyty Naukowe SGGW. Polityki Europejskie, Finanse i Marketing* 8 (57): 366-381.

Poczta Walenty, Paweł Siemiński, Jarosław Sierszchulski. 2012. Przestrzenne zróżnicowanie aktywności rolników w pozyskiwaniu środków unijnych na rozwój gospodarstw rolnych w Wielkopolsce na przykładzie działania „Modernizacja gospodarstw rolnych" (Spatial diversity of activities of farmers in obtaining EU funds for the development of farms in the Wielkopolska voivodship on the example of the measure „Modernisation of agricultural holdings"). *Journal of Agribusiness and Rural Development* 25 (3): 207-223.

Rifkin Jeremy. 2003. *Wiek dostępu. Nowa kultura hiperkapitalizmu, w której płaci się za każdą chwilę* życia (The Age of Access: The New Culture of Hypercapitalism, Where all of Life is a Paid-For Experience). Wrocław: Wydawnictwo Dolnośląskie.

Sass Roman. 2019. *Potencjał produkcyjny indywidualnych gospodarstw rolnych w podregionie bydgoskim a ich efektywność przed i po akcesji Polski do Unii Europejskiej* (Production potential of individual farms in the Bydgoszcz subregion and their effectiveness before and after Poland's accession to the European Union). Bydgoszcz: Kujawsko-Pomorska Szkoła Wyższa w Bydgoszczy.

Sobczyński Tadeusz. 2013. Wybrane uwarunkowania relacji ziemia-praca w gospodarstwach rolniczych Unii Europejskiej (Selected determinants of land-labor relations in European Union farms). *Roczniki Naukowe SERiA* XV (6): 271-277.

Sroka Wojciech, Wiesław Musiał. 2013. Problemy delimitacji małych gospodarstw rolnych w aspekcie projekcji zmian WPR na lata 2014-2020 (Problems of the delimitation of small agricultural farms in terms of the Common Agricultural Policy reform for the years 2014-2020). *Zeszyty Naukowe SGGW. Polityki Europejskie, Finanse i Marketing* 9 (58): 465-478.

Stańko Stanisław. 2008. Zewnętrzne uwarunkowania rozwoju rolnictwa (External conditions of development of Polish agriculture). *Roczniki Nauk Rolniczych. Seria G* 94 (2): 65-79.

The Economist. 1996. Small farms, big portions. *The Economist* 7993, November 23rd.

Vollrath Dietrich. 2007. Land distribution and international agricultural productivity. *American Journal of Agricultural Economics* 89 (1): 202-216.

Wicki Ludwik. 2010a. Zróżnicowanie przestrzenne wykorzystania postępu biologicznego w produkcji roślinnej w Polsce (The level of use of biological progress in plant production in Poland and its spatial differentiation). *Roczniki Nauk Rolniczych. Seria G* 97 (4): 221-229.

Wicki Ludwik. 2010b. *Efekty upowszechniania postępu biologicznego w produkcji roślinnej* (The effects of the biological progres dissemination in plant production). Warszawa: Wydawnictwo SGGW.

Wicki Ludwik. 2012. Convergence of labour productivity in agriculture in the European Union. *Economic Science for Rural Development* 27: 279-284, http://www.esaf.llu.lv/sites/esaf/files/files/lapas/27_intergrated_and_sustainable_development_1.pdf#page=279.

Wicki Ludwik. 2018. The role of productivity growth in agricultural production development in the Central and Eastern Europe countries after 1991. *Economic Science for Rural Development* 47: 514-523. DOI: 10.22616/ESRD.2018.060.

Wicki Ludwik, Robert Pietrzykowski. 2018. Zróżnicowanie przestrzenne wykorzystania środków na modernizację gospodarstw rolnych z Programu Rozwoju Obszarów Wiejskich (Spatial diversification of the use of funds for farm modernization from the rural development program). *Zeszyty Naukowe SGGW. Ekonomika i Organizacja Gospodarki Żywnościowej* 124: 93-108. DOI: 10.22630/EIOGZ.2018.124.32.

Wysokiński Marcin. 2011. Źródła finansowania majątku w gospodarstwach mlecznych a skala produkcji (sources of financing Assets in the Dairy Farms Depending mon the Scale of Production). *Roczniki Naukowe SERiA* XIII (1): 451-456.

Zawojska Aldona. 2014. Globalna grabież ziemi rolniczej postrzegana przez pryzmat ekonomii politycznej (The global land grabbing seen through the prism of political economy). *Roczniki Naukowe SERiA* XVI (4): 369-376.

Zegar Józef. 2009. Kwestia koncentracji ziemi w polskim rolnictwie indywidualnym (The concentration of land in the Polish private agriculture). *Roczniki Nauk Rolniczych. Seria G* 96 (4): 256266.

Ziętara Wojciech. 2003. Wydajność pracy w rolnictwie iw różnych typach gospodarstw rolniczych (Work efficiency in agriculture and in different types of farms). *Roczniki Naukowe SERiA* V (1): 312-317.

Ziętara Wojciech. 2008. Wewnętrzne uwarunkowania rozwoju polskiego rolnictwa (Internal conditions of development of Polish agriculture). *Roczniki Nauk Rolniczych. Seria G* 94 (2): 80-94.
Żmija Dariusz. 2018. Efektywność wykorzystania środków pomocowych WPR współfinansujących projekty inwestycyjne na przykładzie małych gospodarstw rolnych województwa małopolskiego (Effectiveness of CAP support funds used for co-financing investment projects on the example of small farms from the Małopolska Province). *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 18 (2): 334-341. DOI: 10.22630/PRS.2018.18.2.60.

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WIELKOŚĆ A EFEKTYWNOŚĆ GOSPODARSTW ROLNICZYCH

Słowa kluczowe: wielkość ekonomiczna gospodarstw, efektywność w rolnictwie, luka produktywności, postęp technologiczny, struktura agrarna

ABSTRAKT

Celem pracy jest określenie zróżnicowania produktywności czynników produkcji oraz poziomu inwestycji w zależności od wielkości ekonomicznej gospodarstw. Wielkość gospodarstw rolniczych jest jednym z najważniejszych czynników wpływających na poziom ich efektywności. Od rozmiarów gospodarstw zależy możliwość inwestowania i wprowadzania postępu technicznego, osiągane są korzyści skali, zarówno wewnętrzne, jak i zewnętrzne, a także uzyskuje się wyższą produktywność zasobów i wydajność produkcji. Dane do analizy pochodziły z bazy Polskiego FADN i obejmowały lata 2010-2017. Wraz ze wzrostem wielkości ekonomicznej wzrastała produktywność czynników produkcji, wydajność w produkcji roślinnej i zwierzęcej oraz intensywność reprodukcji majątku. Stwierdzono, że gospodarstwa z 1. klasy wielkości (około 10 ha) charakteryzowały się niską efektywnością we wszystkich ocenianych aspektach oraz osiągano w nich gorszą dynamikę zmian. Gospodarstwa średnie (50 ha) osiągały o 30-80% wyższy poziom wszystkich wskaźników efektywności, a w przypadku wydajności pracy, nawet o 600%. Należy podkreślić, że gospodarstwa z pierwszej klasy wielkości nie mają szans rozwojowych, gdyż nie generują wystarczającej nadwyżki wystarczającej na zapewnienie utrzymania rodzinie, prowadzenie inwestycji i wzrost wydajności procesów produkcji. Mogą one pełnić tylko funkcje socjalne oraz jako dodatkowe źródło dochodu w rodzinie. Aby polskie rolnictwo było efektywne konieczne są intensywne procesy koncentracji.

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