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PRODUCTIVITY OF THE POLISH AGRICULTURAL SECTOR COMPARED TO EUROPEAN UNION MEMBER STATES IN 2004-2017 BASED ON FADN FARMS

Key words: productivity, agriculture, European Union

ABSTRACT. The aim of the study was to assess the productivity of the Polish agricultural sector compared to other EU countries in the long-term, encompassing the years 2004-2017. The time range of analyzes covered the years 2004-2017, spatial range of analyzes concerned individual EU countries, and the subjective scope of research included representative farms from these countries. Data was from EUFADN. Therefore, a comparative analysis of synthetic indicators of agricultural productivity in 2004-2006, 2007-2010, 2011-2014 and 2015-2017 was performed. It has been proven that agriculture in Poland, compared to other EU countries, was characterized in the years 2004-2017, almost by the lowest level of resource productivity. The sources of competitiveness of agriculture in Poland in relation to other EU countries result from price differences and not from differences in the productivity of land, capital and labor. The Polish agricultural sector, in the last decade, showed almost the lowest productivity of resources in relation to other EU countries. This was proven by excluding the impact of prices on the differences in resource productivity between EU countries. The increase in the productivity of Polish agriculture is therefore a necessary condition to prevent a progressive decrease in the competitiveness of this sector.

INTRODUCTION

The accession of Poland to the European Union entailed the need of the Polish agricultural sector to compete with identical sectors from other EU countries. The concept of competitiveness has many dimensions [Zawalińska 2004]. However, in the case of competitiveness on the common European market, it refers to the international competitiveness of the Polish agricultural sector in relation to agricultural sectors from other EU countries. In most analyzes, international competitiveness is assessed in the aspect of foreign trade [Pawlak 2013]. Notwithstanding, the price relations of Polish food products in relation to food products from other European Union countries influence results in foreign trade. They are recognized as the main source of international competitiveness and are analyzed by many researchers [Ball et al. 2010, Gorton, Davidova 2001, Szczepaniak 2005]. As Robert Mroczek et al. [2014, p. 32] asserts, however, in conditions

of European integration and globalization, it is increasingly necessary to compete with non-price factors. There is a view in the literature that productivity assessment is one of the right measures of competitiveness, as the efficiency of the use of production factors is taken into account [Wójcik, Nowak 2015, p. 13, Guth, Smędzik-Ambroży 2019, Chryniewicz et al. 2016]. In addition, the European Commission adds that this is the most credible indicator of competitiveness in the long run [EC 2009 in: Nowak 2017, p. 132]. This long-term maintenance of a high level of productivity in agriculture allows both to determine the level of its competitiveness and is one of the key reasons for the transition from industrial to sustainable development of agriculture [Czyżewski 2012, Czyżewski, Smędzik-Ambroży, 2015, 2017, Medina, Potter 2017, Rizov et al. 2013]. In addition, productivity relations between analyzed countries affect relations in terms of cost-efficiency of production, which directly and fundamentally affect the competitive ability of final products on a given market. Therefore, the aim of the article was to determine the productivity of the Polish agricultural sector in the long-term (2004-2017), compared to other European Union countries.

MATERIAL AND RESEARCH METHODOS

In the article, the research approach applied allows to organize individual EU countries in relation to the synthetic index of agricultural productivity. This enabled the ranking of EU countries in relation to the productivity of the agricultural sector and the determination of Poland's position in relation to agricultural productivity in relation to other EU countries which was the purpose of the study. In the first step, productivity ratios of land, capital and labor in agriculture in individual EU countries in each of the years of the research period were calculated. It covered 14 years, namely the years 2004-2017. In order to exclude the impact of prices on productivity differences between EU countries in each of the years of the research period, the value of total agricultural production and the value of fixed assets minus the value of land with purchasing power parities published by Eurostat were realigned. In the case of this indicator, prices in each country are adjusted to average prices occurring throughout the EU. Purchasing power parity allows to solve the problem of international comparisons and is a more appropriate indicator than the exchange rate because it takes into account the purchasing power of the population, reflecting the actual differences in this area [Eurostat 2019b].

In the case of labor and land input, they were expressed in non-cash units, and therefore there was no need to realign them to maintain the comparability of their productivity between individual EU countries. Data on the value of total agricultural production and the amount of land, capital and labor in the agricultural sector of each EU country were taken from the European FADN (Farm Accountancy Data Network). Thus, they concerned the value of total agricultural production and input of factors of production in representative farms from individual EU countries, in each of the years 2004-2017. At this point, it should be added that, in the study, as labor input, units of labor expressed in AWU[1], as

[1] 1 AWU = 2,200 man-hours up to 2010 and from 2011 1 AWU = 2,120 man-hours [Floriańczyk et al. 2018, p. 8].

land use – the area of utilized agricultural land (UAA) in ha, and as capital – the value of fixed assets minus the value of land in EUR were adopted. The final result of this stage of research was to determine the productivity of land, capital and labor in each of the years of the research period in agriculture of each of the EU member states. In the second stage of the research, based on obtained values of productivity indicators for each input, the synthetic index of agricultural productivity in individual EU member states for each year of the research period were calculated. It was assumed that the higher the productivity of input, the greater the total productivity of agriculture. Therefore, each of the productivity indicators stimulated the total productivity of agriculture in a given country. For that purpose each of the productivity indicators were normalized, as follows:

$$-\ stimulants: z_{ij} = \frac{x_{ij} - min_i\{x_{ij}\}}{max_i\{x_{ij}\} - min_i\{x_{ij}\}}, (i = 1,2, \dots, n; j = 1,2, \dots, m);\ z \in [0,1]$$

where: $\min_i\{x_{ij}\}$ – minimum value of j feature, $\max_i\{x_{ik}\}$ – maximum value of *j* feature, *i* – object (in this case country).

As a result of this operation, the values of individual productivity indicators were in the range [0, 1].

Next, we calculated synthetic indicators of productivity in individual EU countries, in each year of the research period. This indicator was the arithmetic average, which included values of normalized productivity ratios of each input. Finally, charts illustrating the ranking of all countries belonging to the EU at a given time in relation to their productivity in agriculture measured by the synthetic indicator were created. At this point, it is worth noting that the more the value of this indicator approaches 1, the greater the position of agriculture productivity in this country is in relation to agricultural sectors in EU countries. This allowed the objective of the study to be implemented, which was to assess the productivity of the Polish agricultural sector compared to other EU countries in the long run. Drawing up the graphs of total productivity in three or four-year periods, namely in 2004-2006, 2007-2010, 2011-2014 and 2015-2017, also allowed to identify changes in the productivity of the Polish agriculture sector in comparison with other EU countries in these research sub-periods. The time range of analyzes covered the years 2004-2017, spatial range of analyzes concerned individual EU countries, and the subjective scope of research included representative farms from these countries.

RESEARCH RESULTS

In the whole research period, the productivity of the Polish agricultural sector compared to other EU countries was almost the lowest. Only adding Croatia to the EU in 2013 meant that this country achieved lower average indicators of total productivity of agriculture than Poland. Sweden and Denmark achieved a slightly higher productivity of the agricultural sector than Poland. From the EU-12 counties it was Slovenia. It should be noted that farmers from all EU-12 countries achieved, on average, in 2004-2017, higher total productivity indicators than Poland (see Figure 1). Farmers from Malta and Slovakia had the highest level of productivity among EU-12 countries. As far as Malta is

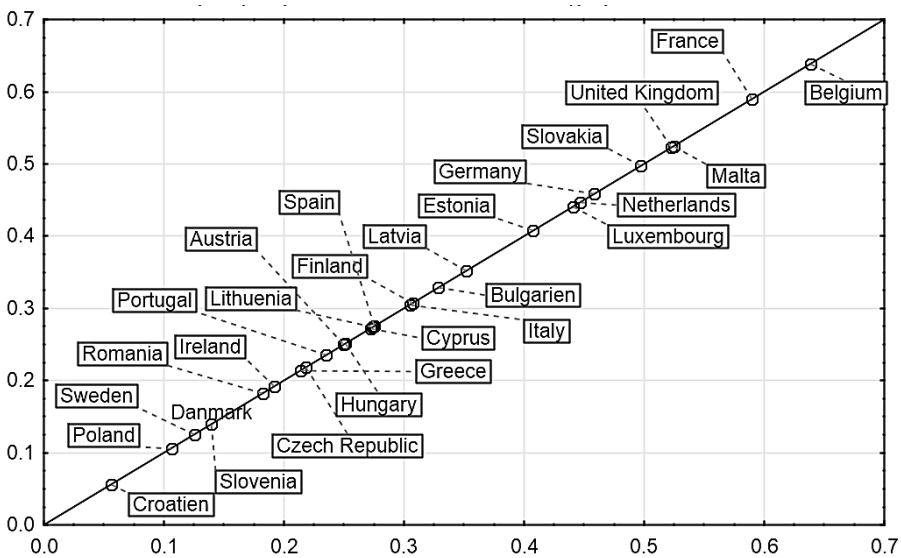

Figure 1. Ranking of agricultural productivity in EU-countries in the years 2004-2017
Source: own elaboration od FADN data

concerned, this was due to considerably smaller area farms in Malta compared to Poland (in 2004-2017 more than 6 times) and by these farms achieving, at the same time, definitely more real agricultural production in total than in the case of Polish farms (in the years 2004-2017 almost six times).

This was reflected in much higher land productivity and labor productivity indicators in the case of agriculture in Malta than in relation to this sector in Poland. In the years 2004-2017, land productivity in agriculture in Malta was on average more than 38 times higher than in Poland, and work productivity almost seven times higher than in Poland (see Table 1). Low input of land and, at the same time, a high labor input of labor and high productivity are characteristic for horticultural production [see Józwiak 2008, p. 201]. The production of vegetables and fruit dominates in the plant specialization of agriculture in Malta [Malta-Agriculture 2019] and in Poland it is the cultivation of cereals [GUS 2018]. It was reflected in the differences in agricultural productivity in these countries (see Table 1). In Slovakia large farms dominate. The average area size of analyzed farms from this country, in 2004-2017, amounted to as much as 550 ha compared to 18 ha for farms from Poland. The average area size of Slovakian farms was also the highest among all EU countries. In second place, in this respect, was the Czech Republic and the United Kingdom, where farm size amounted respectively to 216 ha and 155 ha. A very large area of arable land in farms in Slovakia caused that average land productivity rates in agriculture in this country were lower than in countries with a smaller average size of farms, ie Malta, the Netherlands, Cyprus, Belgium, Italy and Greece (see Table 1). In the whole research period, the highest rates of agricultural productivity were in Belgium and

Table 1. Average productivity of soil, labour and capital in EU-countries in the years 2004-2017

EU – Member States	Productivity of soil [EUR/ha]	Productivity of labour [EUR/AWU]	Productivity of capital [EUR]
Austria	2,059.88	41,931.57	0.21
Belgia	4,710.17	110,121.75	0.42
Bulgarien	798.32	11,873.67	0.68
Croatien	291.76	2,682.71	0.16
Cyprus	4,581.50	30,318.50	0.23
Czech Republic	62.82	2,120.85	0.54
Danmark	410.44	22,422.73	0.19
Estonia	902.50	52,313.42	0.53
Finland	1,316.31	55,559.37	0.26
France	1,795.65	75,534.96	0.72
Germany	2,285.05	86,822.63	0.31
Greece	2,976.65	22,233.39	0.24
Hungary	6.41	191.88	0.64
Ireland	1,189.64	48,140.79	0.06
Italy	3,719.36	49,397.88	0.19
Latvia	862.96	26,690.59	0.61
Lithuenia	890.07	22,529.27	0.47
Luxembourg	2,119.01	97,542.45	0.19
Malta	16,942.56	33,068.72	0.21
Netherlands	10,712.55	140,442.91	0.24
Poland	442.89	4,774.35	0.25
Portugal	1,512.69	23,488.22	0.34
Romania	487.59	3,474.20	0.43
Slovakia	1,123.22	42,353.94	0.81
Slovenia	2,576.69	18,109.95	0.12
Spain	1,620.20	43,931.57	0.27
Sweden	138.95	9,281.28	0.27
United Kingdom	1,727.04	125,501.20	0.17

Source: own elaboration od FADN data

next in France, Malta and the United Kingdom (see Figure 1). Belgium, in comparison with other EU countries, was characterized by high productivity indicators of all resources used in agriculture in 2004-2017. France showed almost the highest productivity of capital used in agriculture in the years 2004-2017 in comparison to other EU countries. This productivity was only slightly higher in Slovakia. On the other hand, the reasons for high total agricultural productivity in the United Kingdom is down to its almost highest labor productivity among all EU countries.

Average labor productivity of agriculture in this country in the years 2004-2017 was over 125501 EUR/AWU. It was only slightly higher in the Netherlands (see Table 1). The differences between EU countries in terms of productivity of each production factor used in agriculture was very large. The largest differences between EU countries occurred in the case of productivity of land (from 16,942 EUR/ha in Malta to 62 EUR/ha in Hungary), then productivity of labour (from 140.443 EUR/AWU in the Netherlands to 192 EUR/AWU in Hungary) and productivity of capital (from 0.81 in Slovenia to 0.06 in Ireland) (see Table 1). Against this background, in the years 2004-2017, Poland was characterized by higher average land productivity in agriculture than: Hungary, the Czech Republic, Sweden, Croatia and higher labor productivity than: Hungary, the Czech Republic, Croatia and Romania. While capital productivity in Polish agriculture in 2004-2017 was higher than in twelve out of 28-EU countries (see Table 1). Nevertheless, the synthetic index of agricultural productivity in Poland in the years 2004-2017, compared to other EU countries, was almost at the lowest level (see Figure 1). It should be added here that despite the fact that Poland, on average throughout the research period, achieved higher land and labor productivity indicators than agriculture in the Czech Republic and Hungary, productivity indicators of the capital of Polish agriculture were more than 2 times lower than in these countries. This caused lower total agricultural productivity in Poland than in the Czech Republic and Hungary.

In the next step, rankings of productivity in agriculture in the EU in three-year (2004-2006 and 2015-2017) or four-year (2007-2010 and 2011-2014) time periods were analyzed. On this basis, it can be said that, in 2004-2006, agriculture in Poland was characterized by higher real productivity than agriculture in Slovenia, Denmark, Sweden and Ireland. It was only in the following years that there was a significant reduction in the total productivity of the agricultural sector in Poland resulting from lower real productivity of land, capital and labor. The effect of this process was that, in the time period 2007-2017, agriculture in Poland achieved almost the lowest real productivity of resources from all EU countries (see Figure 2). This confirms the results of research of Renata Grochowska and Stanisław Mańko. They said that the productivity of individual types of farms in Poland changed in 2004-2012. The highest increase in total productivity took place after Poland's accession to the EU i.e. between the years 2004-2007. Since 2007, in agriculture in Poland, there has been a decrease of total productivity, which reached its lowest level in 2009. In next years, there was an improvement in agricultural productivity in Poland, but already at a lower level than in the years after Poland's accession to the EU [Grochowska, Mańko 2014, p. 31]. It should be added here that, in 2007-2010, agriculture in Denmark showed lower total productivity than the agricultural sector in Poland. In the following years this situation changed and the total productivity of agriculture in Denmark was much higher

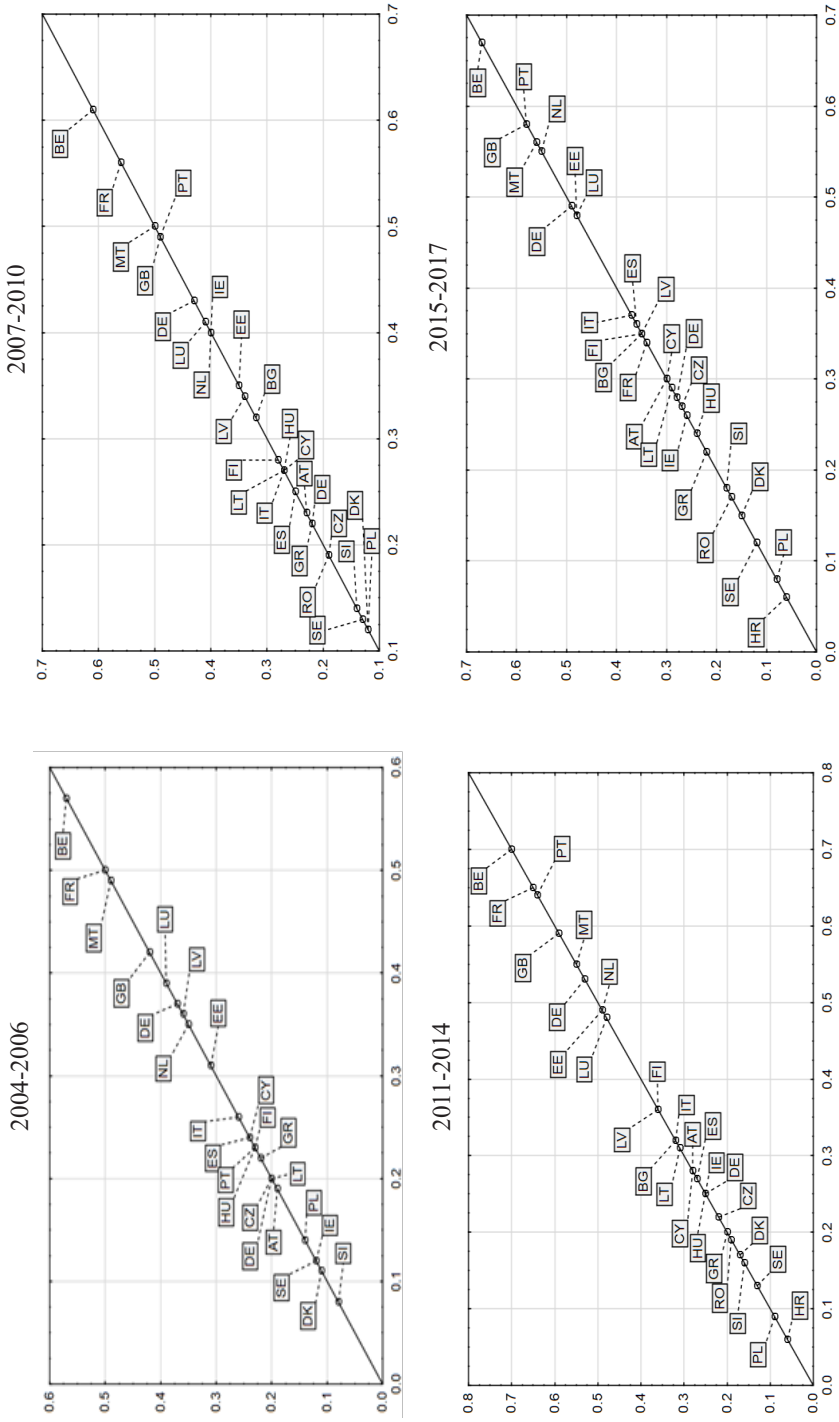

Figure 2. Ranking of agricultural productivity in EU-countries in the year periods 2004-2006, 2007-2010, 2011-2014, 2015-2017
Source: own elaboration od FADN data

than in the agricultural sector in Poland. It was the result of implementing capital-intensive technological progress in farms from Denmark. This is evidenced by an increase in real agricultural production and the value of fixed assets per farm from Denmark in the years 2007-2017 in relation to 2004-2006 with similar input of land and labor in these farms throughout the whole research period. These were increases of 74%, in the case of production, and 78% in the case of fixed assets. However, these increases did not result from changes in price levels, as, on average, in 2007-2017, inflation in Denmark was 1.44% and was lower than in the EU-28, where it amounted to an average of 1.73% [Eurostat 2019a]. The inclusion of Croatia in the EU caused that only this country showed lower productivity of resources than agriculture in Poland, as already mentioned earlier.

This research shows that the sources of competitiveness of agriculture in Poland in relation to other EU countries result from price differences and not from differences in the productivity of land, capital or labor. To prove this, it was necessary to exclude the impact of prices on the differences in resource productivity between EU countries. This view is also confirmed by the research of other authors. Katarzyna Domańska and Anna Nowak [2014] showed that, in 2007-2011, Poland had a higher than 100% coverage rate for food imports by export. At the same time, these authors stated that, in comparison with other EU countries, agriculture in Poland is characterized by one of the lowest indicators of land and labor productivity and a higher capital productivity ratio compared to Western European countries [Domańska, Nowak 2014, p. 35]. Low productivity of resources in agriculture in Poland in relation to other EU countries is also confirmed by the research of other authors [see e.g. Czyżewski, Smędzik-Ambroży 2017]. In turn, Iwona Szczepaniak, in 2005, stated that prices in the agri-food sector in Poland are lower than in developed EU countries. However, as early as 2010, Roman Urban et al., [2010] calculated that the price and cost advantages of Polish agricultural producers are decreasing.

CONCLUSIONS

Permanent differences in resource productivity determine differences in competitiveness over a long period of time. The Polish agricultural sector in the last decade (2007-2017) showed almost the lowest productivity of resources in relation to other EU countries. Its competitive advantages, in relation to agriculture, from other EU countries, resulted mainly from price advantages. However, due to the liberalization process and the unification of markets between individual EU countries, these advantages are decreasing. The increase in the productivity of Polish agriculture is, therefore, a necessary condition to prevent a progressive decrease in the competitiveness of this sector. Therefore, any processes that increase productivity, such as: the implementation of technical progress, digitization, data analytics, an increase in the size of farms and their integration allowing to achieve economies of scale and reducing transaction costs are necessary to maintain the competitiveness of the Polish agricultural sector in the EU.

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ZDOLNOŚĆ KONKURENCYJNA POLSKIEGO SEKTORA ROLNEGO NA TLE KRAJÓW UNII EUROPEJSKIEJ W LATACH 2004-2017 NA PODSTAWIE GOSPODARSTW ROLNYCH FADN

Słowa kluczowe: konkurencyjność, rolnictwo, Unia Europejska

ABSTRAKT

Celem opracowania jest ocena zdolności konkurencyjnej polskiego sektora rolnego na tle pozostałych krajów Unii Europejskiej w długim czasie, odejmującym lata 2004-2017. Analizy dotyczyła danych za lata 2004-2017. Przedmiotem badań były kraje członkowskie Unii Europejskiej, a zakres badań obejmował reprezentatywne gospodarstwa rolne z tych krajów. Dane pochodziły z FADN. Dokonano analizy porównawczej syntetycznych wskaźników zdolności konkurencyjnej rolnictwa w latach 2004-2006, 2007-2010, 2011-2014 i 2015-2017. Dowiedziono, że rolnictwo w Polsce, w porównaniu z krajami UE, charakteryzowało się w latach 2004-2017 najniższą zdolnością konkurencyjną, wynikającą z produktywności zasobów. Polski sektor rolny w ostatniej dekadzie wykazał niemal najniższą wydajność zasobów w stosunku do innych krajów UE. Źródła konkurencyjności polskiego rolnictwa względem innych krajów UE wynikały z różnic cenowych, a nie z różnic w produktywności ziemi, kapitału i pracy. Stwierdzono to na podstawie analiz, w których wyeliminowano wpływ cen na różnice w produktywności zasobów pomiędzy krajami UE. Wzrost produktywności polskiego rolnictwa jest więc koniecznym warunkiem, aby zapobiec postępującemu spadkowi konkurencyjności tego sektora.

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