

LAND PRODUCTIVITY AND ITS PRICES IN THE COUNTRIES OF EU-15 AND EU-12¹

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Abstract. The aim of article is assessmet the impact of the affiliation of the country to the EU-15 or EU-12 on agricultural land productivity and its price. The tasks of article are evaluation of intensity in agriculture in the countries EU-15 and EU-12 and evaluation of differences in land productivity and its prices between EU-12 and EU-15 countries in years 2007-2013. The analysis showed that in the 2007-2013 period the EU-15 and EU-12 significantly differed in capital intensity. It is also proved that capital intensity of agriculture determines the productivity of agricultural land and its price. In the EU-15 countries (with higher intensity of capital), were higher rates of land productivity and land prices as well as were the relationship between these values. In the EU-12 (with lower intensity of capital), were much lower rates of land productivity and land prices and there was no link between the productivity of agricultural land and its prices. Time range of analysis included the period of 2007-2013 and spatial range of analysis included representative farms from EU-15 and EU-12 countries. Due to the lack of information regarding prices of agricultural land in Cyprus, Malta, Greece, Luxembourg, Austria, Portugal and Slovenia, these countries were excluded from the analysis.

Key words: agriculture, land productivity, intensity of capital, prices of agricultural land.

Introduction

Regardless of the system of agricultural production (extensive or intensive management in the agricultural sector), land resources and its prices are determinant of the efficiency of agricultural production. Agriculture is not the only one but the most important user of the land due to the spatial nature of production and occupying large areas (Baer-Nawrocka, Mrowczynska, 2007; Masniak, 2010; Majchrzak, 2015). Frequently intensification of agricultural production is associated with an industrial (conventional) farming model, which had performed commonly since the end of the World War II until the first oil crisis (Clock, 2014, pp. 198-199, 203; Czyzewski A., Czyzewski B., 2015). The example of agriculture and agricultural policy of the EU shows that political considerations play a crucial role in creating conditions for the development of agriculture and its intensification. The EU agricultural policy, i.e. the Common Agricultural Policy (CAP) was established as a response to the need to ensure food security for Europe's citizens, and although it has been significantly modified for more than 50 years, it should be noted that these changes were possible through the achievement of this safety (Judzińska, Łopaciuk, 2011; Zieliński,

2016). In support of this statement, it is worth quoting the original objectives of the EU agricultural policy. Article 33 of the Treaty Establishing the European Community specified the following (version 2016):

- to increase agricultural productivity by promoting technical progress, rational development of agricultural production and the optimum utilization of the factors of production, in particular labour;
- thus, to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture;
- to stabilize markets;
- to ensure security of supply;
- to ensure reasonable prices in supplies to consumers.

From above statements one can conclude that countries with long membership in the EU have been subjected to the influence of institutional considerations to a greater extent, aimed at increasing the efficiency of European agriculture, which is reflected in the primary objectives of the CAP. It was not actualized until the reform of the EU agricultural policy in 1992, when there was introduced a method of less intensive agricultural

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production in the EU by changes in individual agricultural markets (Brouwer, Lowe 2000, p. 5; Fiedor, 2004).

The phenomenon of the intensity of agricultural production in the traditional sense expresses the relationship between the factors of labour and capital, and the factor of land. Its degree is measured by the size of consumption of labour (AWU¹ and capital) per area unit. It, therefore, expresses the sum of the inputs flowing through all branches of the production in a given time unit with respect to the land area (Adamczuk, 1996). This means that as agricultural production gets more intense, the greater the amount of labour and means of production per 1 ha is. The process of growth of living and objectified labour per area unit is called intensification. Basically, there are two ways of intensification of agricultural production: labour intensive and capital intensive. The first of these types means, above all, a change in crop structure and the introduction of more labour-intensive crops (root or industrial crops) and an increase in the number of livestock. It is usually practised in small-area farms leading to increased farming scale with extensive nutrition due to limited growth of the sown area. This, in turn, determines an increase in the material consumption in the form of industrial feed. In this type of intensification, land productivity growth is usually accompanied by a relative decrease in labour productivity. The second type of intensification leads to increased land productivity through higher yields and quantity of production means (fertilizers, pesticides, animal feed, industrial certified seed). The most important reasons for such intensification of farms are (Czyzewski, Smedzik-Ambrozy 2013, p. 29):

- limited land resources,
- low natural fertility of the soil and climatic conditions, especially unfavourable rainfall

causing frequent imbalance in the water balance and the efficiency of fertilization.

It is assumed that the higher costs of labour and capital per unit of land, the greater the intensity of agricultural production is. Therefore the aim of article is assessmet the impact of the affiliation of the country to the EU-15 or EU-12 on agricultural land productivity and its price. The tasks of article are evaluation of intensity in agriculture in the countries EU-15 and EU-12 and evaluation of differences in land productivity and its prices between EU-12 and EU-15 countries in years 2007-2013.

Research methodology

As the rate of land productivity, there was total agricultural production (131 SE) per ha of utilized agricultural area (025 SE) of representative farms in the EU-15 and EU-12 used. There were average values for the years 2007-2013 used. To determine the differences in the intensity of agriculture between the EU-15 and EU-12, there were indicators labour and capital intensity used. The first of them was labour input in AWU (SE 010) per ha and the other concerning capital intensity was understood as the sum of the value of buildings (SE 450), machinery and transport equipment (SE 455), fertilizers (SE 295) and pesticides (SE 300) in EURO per ha. Since the sample size was less than 30, in order to evaluate the statistical significance of differences in the intensity of agriculture, there was exact U Manna-Whitney test applied (Stanisz 2007, p. 223)². It allowed answering the question of whether the EU-15 and EU-12 significantly differed in labour and capital intensity. Average indicators of the intensity of agriculture and land productivity and its prices per 1 ha in representative farms for the EU-15 and EU-12 are included in Table 1. Then there was one-dimensional and univariate ANOVA analysis carried out, in which the qualitative predictor was the affiliation of the country to the EU-15 or EU-

¹ AWU (Annual Work Unit). In years 2007-2010 1 AWU=2 200 hours per year, and from 2011 year 1 AWU=2 120 hours per year (Floriańczyk et al. 2014, p. 4-6).

² It is assumed that a large sample covers more than 50 observations (Stanisz 2007)

12 and the dependent variables, which were the average prices of agricultural land in 2007-2013 per ha and the average productivity of agricultural land in years 2007-2013. Differences are statistically significant if the significance level (p) is less than 0.05. The analysis excludes Cyprus, Greece, Luxembourg, Malta, Austria, Portugal, Slovenia, due to lack of data regarding prices of agricultural land in these countries. Applied research methodology allowed determining whether the intensity of agriculture was a determinant of productivity and agricultural land prices in 2007-2013. In the conclusion, there was an analysis of the correlation between indicators of land productivity and its prices in the EU-15 (excluding Greece, Luxembourg, Austria, Portugal) and the EU-12 (excluding Cyprus, Malta and Slovenia) in each year of the research period (2007- 2013) performed. In this case, the aim was to answer the question whether in the groups of countries that differ in intensity of agriculture, there were differences in the strength and direction of the relationship between the productivity of agricultural land and its prices.

Results

In the EU-15 compared to the EU-12 there were both - higher capital intensity of production per ha of utilized agricultural area (more than 2 times) and land productivity (more than 3 times). There were also significantly higher average land prices in 2007-2013. In the EU-15, land prices were up to 6 times higher than in EU-12 countries (Table 1). Thus the results confirm that in the EU-15 price of the agricultural land are significantly higher than in the EU-12 countries, although the fastness of price growth is much faster in the EU-12 than in the EU-15 (Majchrzak 2015, p. 205). The statistical significance of differences in capital intensity and land productivity and its prices among the EU-15 and EU-12 was confirmed by U Mann-Whitney test. In the EU-12, there was slightly higher average labour intensity of production per area unit (Table 1). However, the differences in this regard between the EU-15 and EU-12 were not statistically significant ($p=0.11$). On this basis, we can say that the EU-15 compared to EU-12 was characterized by higher intensity of agriculture, namely a much greater capital intensity of production per unit of land resource.

Table 1

Average indicators of labour and capital intensity of agriculture and the productivity of the land and its prices in clusters of the EU countries in 2007-2013.

Countries	Number of countries	Labour intensity [labour input in AWU per ha]	Capital intensity [capital input in EUR per ha]	Land productivity [total agricultural production in EUR per ha]	Prices of agricultural land [in EUR per ha]
EU-15	11	0.035	1896.03	3300.11	18877.81
EU-12	9	0.058	735.81	1049.74	3101.08
Totality	20	0.045	1373.93	2287.44	11778.28

Source: authors' study based on EUFADN data

The evaluation results of statistical significance proved the existence of impact of affiliation of the EU-15 and EU-12 on both land productivity as well as its prices. In both cases, p was less than 0.05 (Table 2). Therefore, there are reasons to conclude that membership in the EU-15 or EU-12 affected both the productivity of

agricultural land and its price. In the EU-15, in 2007-2013 occurred both - higher than the average productivity of agricultural land and its prices than in countries with lower capital intensity, i.e. in the EU-12 countries (Table 1 and Table 2).

Table 2

The results of evaluation of the statistical significance of differences in productivity and prices of agricultural land [in EUR per ha] between clusters of countries in the EU (one-way tests of significance, parameterization with sigma-limits, decomposition of effective hypotheses – differences are significant: $p < 0.05$)

	Variable	SS	MS	F	p
The affiliation of the country to the EU-15 or EU-12 as a qualitative predictor	productivity of land [in EUR per ha]	25067576	25067576	4.46558	0.048811
	Land prices [in EUR per ha]	1.232080E+09	1.232080E+09	10.93929	0.003916

Source: authors' study based on the data from EUROSTAT and EUFADN

The results confirm the conclusions Majchrzak and Smedzik-Ambrozy (2017), according to which agriculture of the EU-15 countries get a higher productivity of agricultural land than the agriculture in EU-12 countries. They also noted that the EU agricultural policy during the last financial perspective (2007-2013) did not contribute to the reduction of disparities between the productivity of the land in agriculture between the EU-15 countries and EU-12 countries (Majchrzak, Smedzik-Ambrozy 2017). It also follows from research A. Tarnowska (2014, p. 216) in which it stated that in the EU-15 countries was in 2012 double higher productivity of the land than in agriculture of EU-12 countries. It proved to them that these differences were the result of differences in the degree of intensity of agriculture between compared groups of countries. This was confirmed also in this research, because their results show that agriculture from the EU-15 countries characterized by higher productivity of land as

well capital intensity per hectare of agricultural land.

The results in Table 3, in turn, proved a significant linear association between land productivity and its prices across the EU. It is represented by significant and high correlation coefficients in each of the years of the study period with the exception of 2009. On this basis we can say that in 2010-2013 there was a positive, linear relationship between the productivity of agricultural land and its prices, which remained throughout the whole EU on a very high level, as evidenced by the average correlation coefficient for the period, amounting to up to 0.87¹. Compared to previous years, this relationship has intensified. Interesting conclusions about the collinearity of productivity of agricultural land and its prices provide in particular the distribution of the EU countries for the EU-15 and EU-12, as demonstrated before, significantly different in capital intensity of agriculture.

Table 3

Pearson correlation coefficients between the prices of agricultural land and its productivity in the EU countries, differing in capital intensity of agriculture in the years 2007-2013

	Cluster	2007	2008	2009	2010	2011	2012	2013
Correlation coefficients	EU-15	0.41	0.61*	0.17	0.85*	0.85*	0.84*	0.86*
	EU-12	-0.24	-0.24	-0.16	-0.11	0.047	0.047	0.056
	EU	0.54*	0.69*	0.33	0.87*	0.87*	0.86*	0.88*

Source: authors' study based on the data from EUROSTAT and EUFADN

* significant correlations

It must be said that throughout the study period in the EU-12 countries characterized by a lower capital intensity of agriculture than in the EU-15 countries, appeared insignificant relationship between the productivity of agricultural land and its prices for ha (Table 3).

This means that in the EU-12, price of agricultural land resource to a large extent was determined by the factors not related to the productivity of the land. Such factors include, for example, legal regulations as well as the demand and supply of this resource. Based on the results

¹ The values of Person correlation coefficient means: up to 0.2 - no linear relationship, 0.21 - 0.4 - weak relationship, 0.41 - 0.7 - moderate dependence, 0.71 - 0.9 - a fairly strong relationship, > 0.9 - a very strong correlation (Statystyka 2016).

we can say that the statement Weil (2003, pp. 156-166) that today the quality of the land, affecting its productivity, determines the price of agricultural land is not valid for EU-12 countries. Contrarily is in the EU-15 countries, where the research showed high correlation coefficients between the productivity of agricultural land and its prices in each year of the last financial perspective of the EU (2007-2013), with the exception of years 2007 and 2009. It should also be noted that in the years 2010-2013 the linear relationship between the productivity of agricultural land and its prices in the EU-15 countries has intensified, as compared to the previous period, and the average correlation coefficient for this period was 0.85.

Therefore, the studies show that the EU-15 and EU-12 countries differ significantly capital intensity, productivity of agricultural land and its prices. In connection with this aim and tasks of article have been achieved. Practical significance of results follow from the fact that, depending on the groups (EU-15 or EU-12) to perform or not perform the relationship between the productivity of agricultural land and price of agricultural land. Results show that, in the EU-15 in years 2007-2013, the higher productivity of the land was reflected in higher price of agricultural land. Such a relationship was not present in the EU-12 countries.

Conclusions, proposals, recommendations

In conclusion, it is worth noting the following:

- 1) Limitation and lack of mobility of agricultural land is one of the most important prerequisites of intensification of agricultural production. It aims to increase agricultural productivity and can be done in two ways. The first is associated with increased consumption

of labour and the other with capital intensity concerning fixed assets, i.e. agricultural machinery and equipment and current assets, i.e. fertilizers and pesticides per land unit.

- 2) Finding is also reflected in the intensity of European agriculture, which was confirmed by research. It turned out that the agriculture of the UE-15 countries is characterized by decidedly higher level of capital intensity than agriculture from the EU-12 countries. While statistically insignificant between the EU-12 and EU-15 were differences in the labour intensity.
- 3) Studies have shown the impact of capital intensity in agriculture on productivity of agricultural land and prices of this resource. It turned out that in countries with a higher capital intensity of agriculture (EU-15) is a positive relationship between the productivity of agricultural land and its prices. This compound was not present in countries with lower capital intensity of agriculture (EU-12). In this regard, it should be noted that in the EU-12 prices of land resource are determined by non-productive factors, i.e. legal conditions, governing the availability of this resource as well as its size. On the contrary, in the EU-15, there is a strong positive relationship between the prices of agricultural land and its productivity.
- 4) Conducted studies also showed that farmers from the EU-15 achieve significantly higher production results per unit of land and higher prices of this resource than in the EU-12. The research results testified that statistically significant differences in the average rates of productivity and agricultural land prices (per ha) between the EU-15 and EU-12 existed.

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