https://doi.org/10.17221/378/2018-AGRICECON

Differentiation in the production potential and efficiency of farms in the member states of the European Union

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Citation: Nowak A., Różańska-Boczula M. (2019): Differentiation in the production potential and efficiency of farms in the member states of the European Union. Agricultural Economics – Czech, 65: 395–403.

Abstract: This paper contains an evaluation of the differentiation of the production potential and efficiency of farms in the member states of the European Union in 2013–2016. To this end, a taxonomic method – Hellwig's development measure – was used. The study was based on data from the European Union Farm Accountancy Data Network (FADN). The study results indicate that member states such as the Netherlands, Denmark, Luxembourg, Belgium, the United Kingdom and Slovakia were characterised by the best agricultural production potential. The first four member states also showed the highest efficiency with regard to the utilisation of production factors. On the other hand, low and average potential and efficiency were characteristic of farms in most of the new member states.

Keywords: agriculture; European Union members; potential of farms; production factors; synthetic indicator

Agriculture is the main land user in the European Union (EU), accounting for more than 47% of the region's total area (Giannakis and Bruggeman 2015). Despite the decline in the relative economic weight of the primary sector as an inevitable consequence of economic progress (Byerlee et al. 2009), its economic role still remains significant in many countries. The significance of agriculture differs from country to country due to the fact that agriculture in the European Union is characterised by large internal differentiation. The results of studies by Nowak et al. (2016) point to strong diversification of the level of agricultural development among the member states of the European Union. This is a result of natural conditions, the potential, the level of social and economic development of respective countries and different lengths of time over which they have been members of the community. Studies by the authors mentioned above indicate that the worst in the ranking of agricultural development level were mainly those countries whose accession to the EU took place in 2004 or afterwards. Recent changes in agriculture in the European Union have been mainly a result of the influence the Common Agricultural Policy had on that sector, globalisation and integration as well as increasing economic interdependence in the EU (Pawlewicz and Pawlewicz 2018). The EU enlargement has resulted in an increased diversity of farm structure (Popescu et al. 2015). The most evident and policy-relevant structural developments in EU agriculture are reflected in the declining number of farms and farm size growth (Neuenfeldt et al. 2018). It is also a necessary condition for undertaking studies not only at the level of the agricultural sector but also at the level of farms. It is particularly important to examine the production potential of farms. This potential determines the factor competitiveness of farms (Matyja 2016).

The production potential of agriculture as well as respective agricultural entities, i.e. farms, is a sum of natural resources, methods of their utilisation, natural conditions, workforce, technical means and fundamental economic conditions (Siudek and Zawojska 2014; Kreneva 2015). Barthelemy and David (2001), as well as Pawlewicz and Pawlewicz (2018), emphasise that the proof of the production potential

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and production capacity of agriculture is the presence of production resources. In turn, the ability to utilise the potential and develop optimum relations between production factors has an influence on the efficiency of the production process and work efficiency. The size, quality and structure of production resources and their efficient use, apart from the social and economic system and economic policy, are the key factors determining the competitiveness of the specific economy and its sectors (Latruffe 2010; Matyja 2016; Pawlewicz and Pawlewicz 2018).

The differentiation of member states in terms of the production potential is determined by multiple factors, the major ones being natural conditions, level of social and economic development, including the role of agriculture in the economy, as well as historical background (Christiaensen and Swinnen 1994). The production potential of agriculture, and hence its competitive capacity, is determined not only by the resources of production factors but also by their quality and relations between them. The quantitative proportions between production factors in agriculture in different member states are considerably differentiated and in addition change greatly in time (Nowak et al. 2016). The factors shaping production potential efficiency include the directions of agricultural production, the intensity of management, relations between prices of respective factors and their actual availability (Ciutacu et al. 2015).

Knowledge of the potential production capacity of agriculture is essential since it makes it possible to determine the directions of the agricultural sector development strategy for a specific country or region. Therefore, the purpose of this paper is to evaluate the differentiation of the production potential of farms in the European Union and the efficiency of its use in 2013–2016. The studies supplement literature regarding the diversification of the level of agricultural development in the European Union. A value added to this paper is the self-designed set of features characterising both the production potential and the effectiveness of its utilisation by farms. Many scientific studies in this area are based on a selected aspect of differentiation of agriculture, e.g. productivity or trade. In addition, international comparisons involving all EU member states rather refer to sectoral than microeconomic analyses.

MATERIAL AND METHODS

The differentiation of the conditions of agricultural production in respective countries as well as the specific nature of the agricultural sector makes an evaluation of the production potential of agriculture and efficiency of the utilisation of resources on a national scale quite a difficult task. In order to analyse complex phenomena such as the level of development or the potential of agriculture, it is necessary to consider many factors (Bryden 2002). For this reason, the production potential of farms and their efficiency in 28 member states of the European Union were evaluated using a popular taxonomic method – Hellwig's development measure. This method synthesises factors of a different nature (originating from different sources) and allocates them to a single, synthetic aggregate measure (Poczta-Wajda and Poczta 2016; Leń et al. 2017). It is determined based on standardised values of features which in the case under consideration were the larger-the-better (LTB) characteristics.

The level of the analysed phenomenon was first determined by the distance of the objects from the adopted model, and then the values of aggregate variables m_i (i = 1, 2, ... , n), (n = 28 countries) were estimated on the basis of:

$$m_i = 1 - \frac{d_{i0}}{d_0} \tag{1}$$

where d_{i0} is Euclidean metric in the following form:

$$d_{i0} = \sqrt{\sum_{j=1}^{m} \left(z_{ij} - z_{0j}\right)^2} \tag{2}$$

and $z_{0j} = \max_i \left\{z_{ij}\right\}$ (3)

for j^{th} simple variable, $z_{ij} = \frac{x_{ij} - \overline{x}_j}{S_j}$,

where z_{ij} is standardized variable; x_{ij} is the value of the object number i (i = 1, 2, ... , n) and characteristic number j (j = 1, 2, ... , m),

$$\overline{x}_j = \frac{1}{n}\sum_{i=1}^{n} x_{ij},\ S_j = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(x_{ij} - \overline{x}_j\right)^2}.$$

Furthermore:

$$d_0 = \overline{d}_0 + 2S\left(d_0\right) \tag{4}$$

where:

$$\overline{d}_0 = \frac{1}{n}\sum_{i=1}^{n} d_{i0} \text{ and } S\left(d_0\right) = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(d_{i0} - \overline{d}_0\right)^2} \tag{5}$$

These values were used for calculating the arithmetic mean of synthetic measure $\overline{m} = \frac{1}{n}\sum_{i=1}^{n} m_i$ and the standard deviation $S_m = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(m_i - \overline{m}\right)^2}$. Then objects were

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grouped into four classes:

I. Objects with the best results: $m_i \geq \bar{m} + S_m$;
II. Objects with above-average results: $\bar{m} \leq m_i < \bar{m} + S_m$;
III. Objects with below average results: $\bar{m} - S_m \leq m_i < \bar{m}$;
IV. Objects with very poor results: $m_i < \bar{m} - S_m$.

Thus, 28 analysed member states were split into four uniform groups characterised by a similar production potential, efficiency of its utilisation, as well as production and economic results generated by farms. The study covered results from 3 years, i.e. 2013–2016, which made it possible to eliminate the effect of weather on the production results of farms. The study was based on data from the EU Farm Accountancy Data Network (EU FADN Database 2018). FADN is a European system collecting accountancy data from farms. Its field of observation covers commodity farms. It should be emphasised that FADN is the only database for the needs of which information is collected according to uniform rules, and farms create a statistically representative sample of commodity farms operating within the territory of the European Union.

At the first stage of the research procedure, the indicators were initially selected based on studies of reference literature. Fourteen diagnostic variables were selected characterising accordingly the production potential, the efficiency of its utilisation, and production and economic results. Variables determining the production potential include resources or expenditure, and relations between them, as well as the economic value of a farm (expressed as standard output). Partial productivity indicators were deemed variables characterising production effectiveness. On the other hand, production and economic results were examined by means of variables expressing production and profitability.

Production potential:

X_1 – utilised agricultural area (UAA) per 1 AWU (Annual Work Unit), (ha/AWU);
X_2 – total fixed assets per 1 AWU, (EUR/AWU);
X_3 – economic size of farms, (EUR/farm);
X_4 – average area of the farm, (ha);
X_5 – gross investment per 1 ha UAA, (EUR/ha);
X_6 – total inputs per 1 ha UAA, (EUR/ha).

Production potential efficiency:

X_7 – capital productivity – production value per 1 EUR of total costs, (EUR);
X_8 – land productivity – production value per 1 ha UAA, (EUR/ha);
X_9 – workforce productivity – production value per 1 AWU, (EUR/AWU);
X_{10} – workforce profitability – net income per farm per 1 AWU, (EUR/AWU).

Production and economic results:

X_{11} – production value per 1 farm, (EUR);
X_{12} – average net income per farm, (EUR);
X_{13} – net value added per 1 AWU, (EUR/AWU);
X_{14} – crop production per 1 ha of UAA, (EUR/ha).

Afterwards, they were verified in terms of formal criteria, i.e. whether they are measurable, complete and comparable, and in terms of statistical criteria (coefficient of variation above 10% and exclusion of redundancy). They were used to develop and compare the synthetic measures m_i of the production potential, efficiency of its utilisation and production and economic factors in member states covered by the analysis in 2013–2016.

RESULTS

All the above-presented variables were considered boosters (the-larger-the-better characteristics) with high values being desirable from the point of view of the studied phenomenon. Features taken into account in the study were assigned statistical characteristics presented in Table 1 (Mean – arithmetic mean; Me – median; Min – minimum value; Max – maximum value; S – standard deviation; Sk – skewness; V – coefficient of variation). Positive values of Sk suggests that the analysed variables are characterised by right-side asymmetry, that is, in most EU member states they were lower than the mean value. The highest variability, and hence importance was observed for the following variables: for the potential – average area of the farm, for efficiency – land productivity, whereas for production and economic factors – crop production per 1 ha of UAA. The lowest values of the analysed variables were recorded for Romania as many as four times. On the other hand, member states with the highest results for the analysed features were Denmark, Slovakia, and Malta.

The variables used in the study made it possible to develop the synthetic measure m_i describing the production potential of farms in respective EU member states and rank them with regard to the value of the measure in 2013–2016 (Table 2). However, Figure 1 shows the value of the measure for respective member states and each analysed year with regard to the average level of the aggregated measure for the entire analysed period.

Analysing the values of the synthetic measure in 2013–2016, we can notice that in that period syn-

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Table 1. Characteristics of diagnostic variables describing production potential, efficiency of its utilisation, and production results of farms in the EU member states

Variable	Mean	Me	Min	Max	S	Sk	V (%)
X_1	30.08	28.32	1.97 (Malta)	74.79 (United Kingdom)	19.96	0.64	66
X_2	268 757.94	130 645.57	22 576.45 (Bulgaria)	1 217 754.59 (Denmark)	293 733.33	1.72	109
X_3	127.74	62.93	9.55 (Romania)	464.90 (Slovakia)	128.34	1.32	100
X_4	74.50	48.27	2.74 (Malta)	534.21 (Slovakia)	100.51	3.64	135
X_5	433.93	255.46	61.34 (Romania)	1 935.20 (Netherlands)	408.38	2.15	94
X_6	2 685.76	1 714.53	750.79 (Lithuania)	12 796.64 (Malta)	2 923.87	2.88	109
X_7	0.96	0.97	0.66 (Italy)	1.32 (Finland)	0.15	0.12	16
X_8	2 902.48	1 686.65	766.39 (Lithuania)	15 522.60 (Malta)	3 384.58	3.06	117
X_9	65 425.18	49 037.70	10 312.55 (Romania)	240 460.53 (Denmark)	55 077.37	1.50	84
X_{10}	12 273.51	11 033.05	2 829.36 (Slovakia)	28 125.17 (Luxembourg)	7 572.78	0.61	62
X_{11}	147 033.53	70 288.75	11 480.50 (Romania)	609 532.00 (Slovakia)	152 864.54	1.57	104
X_{12}	23 640.17	19 059.63	4 740.50 (Slovenia)	64 424.00 (Netherlands)	16 353.82	0.92	69
X_{13}	22 602.82	19 964.86	3 890.00 (Slovenia)	71 088.09 (Denmark)	15 993.61	1.17	71
X_{14}	1 370.55	899.65	245.57 (Ireland)	6 991.81 (Malta)	1 497.66	3.05	109

X_1 – utilised agricultural area (UAA) per 1 AWU (ha per AWU); X_2 – total fixed assets per 1 AWU (EUR/AWU); X_3 – economic size of farms (EUR per farm); X_4 – average area of the farm (ha); X_5 – gross investment per 1 ha UAA (EUR/ha); X_6 – total inputs per 1 ha UAA (EUR/ha); X_7 – capital productivity – production value per 1 EUR of total costs (EUR); X_8 – land productivity – production value per 1 ha UAA (EUR/ha); X_9 – workforce productivity – production value per 1 AWU (EUR/AWU); X_{10} – workforce profitability – net income per farm per 1 AWU (EUR/AWU); X_{11} – production value per 1 farm (EUR); X_{12} – average net income per farm (EUR); X_{13} – net value added per 1 AWU (EUR/AWU); X_{14} – crop production per 1 ha of UAA (EUR/ha); Mean – arithmetic mean; Me – median; Min – minimum value; Max – maximum value; S – standard deviation; Sk – skewness; V – coefficient of variation

Source: own study based on the EU FADN Database (2018)

thetic measures ranged from 0.05 to 0.44. On average, the highest production potential throughout the study period was observed for member states such as the Netherlands, Denmark, Luxembourg, the United Kingdom, Slovakia, and Belgium. The first member state mentioned above recorded the maximum values for variables X_5 and X_6, Slovakia for X_3 and X_4, the United Kingdom was characterised by the largest utilised agricultural area (UAA) per 1 AWU, whereas Denmark had the highest level of technical resources among the EU member states. The second group with a high production potential was formed

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Table 2. Ranking of EU member states according to synthetic measures expressing production potential of farms (on average in 2013–2016)

Class	Value of synthetic measure (m_i)	Country	Ranking
I	0.4411	Netherlands	1.
	0.4174	Denmark	2.
	0.3585	Luxembourg	3.
	0.3350	United Kingdom	4.
	0.3341	Slovakia	5.
	0.3181	Belgium	6.
II	0.3032	Sweden	7.
	0.2932	Germany	8.
	0.2635	Czech Republic	9.
	0.2362	Finland	10.
	0.2349	France	11.
	0.2305	Malta	12.
	0.2196	Ireland	13.
	0.2103	Estonia	14.
III	0.1939	Austria	15.
	0.1574	Slovenia	16.
	0.1428	Latvia	17.
	0.1400	Italy	18.
	0.1380	Hungary	19.
	0.1307	Spain	20.
	0.1239	Lithuania	21.
	0.1153	Cyprus	22.
	0.1058	Croatia	23.
IV	0.1029	Bulgaria	24.
	0.0957	Poland	25.
	0.0943	Portugal	26.
	0.0851	Greece	27.
	0.0545	Romania	28.

Source: own study based on the EU FADN Database (2018)

Table 3. Ranking of EU member states according to synthetic measures expressing the utilisation efficiency of production potential of farms (on average in 2013–2016)

Class	Value of synthetic measure (m_i)	Country	Ranking
I	0.6178	Netherlands	1.
	0.4785	Denmark	2.
	0.4157	Belgium	3.
	0.4138	Luxembourg	4.
II	0.3721	Sweden	5.
	0.3702	Germany	6.
	0.3477	United Kingdom	7.
	0.3452	Finland	8.
	0.3273	France	9.
	0.2966	Malta	10.
	0.2579	Austria	11.
	0.2527	Ireland	12.
III	0.2480	Czech Republic	13.
	0.2235	Hungary	14.
	0.2219	Estonia	15.
	0.2073	Slovakia	16.
	0.2012	Italy	17.
	0.1873	Cyprus	18.
	0.1852	Slovenia	19.
	0.1797	Latvia	20.
	0.1734	Spain	21.
	0.1703	Lithuania	22.
	0.1530	Bulgaria	23.
	0.1432	Greece	24.
IV	0.1392	Poland	25.
	0.1224	Portugal	26.
	0.1129	Croatia	27.
	0.1121	Romania	28.

Source: own study based on the EU FADN Database (2018)

by eight member states, i.e. Sweden, Germany, the Czech Republic, Finland, France, Malta, Ireland, and Estonia. An average potential was shown by 9 member states, 6 of which were new EU member states (Slovenia, Latvia, Hungary, Lithuania, Cyprus and Croatia). On the other hand, a low level of the production potential measure was observed for Bulgaria, Poland, Portugal, Greece and Romania. Bulgaria had the lowest value of fixed assets per 1 AWU (X_2) of all member states, while Romania attained the minimum values for variables X_3 and X_5. Analysing the values of the synthetic measure in respective years, its relatively stable level could be noticed in most member states. In Croatia, in 2016 a relatively high increase in the value m_i was observed, which moved the country from class IV to class III, i.e. a group of member states with an average production potential of farms (Figure 1).

Farms can be competitive if they have adequate production potential and use it efficiently (Latruffe 2010; Vavřina and Basovníková 2015). Table 3 presents the values of the synthetic measure expressing the efficiency of utilisation of the production potential of farms in EU member states in 2013–2016. Four groups of farms

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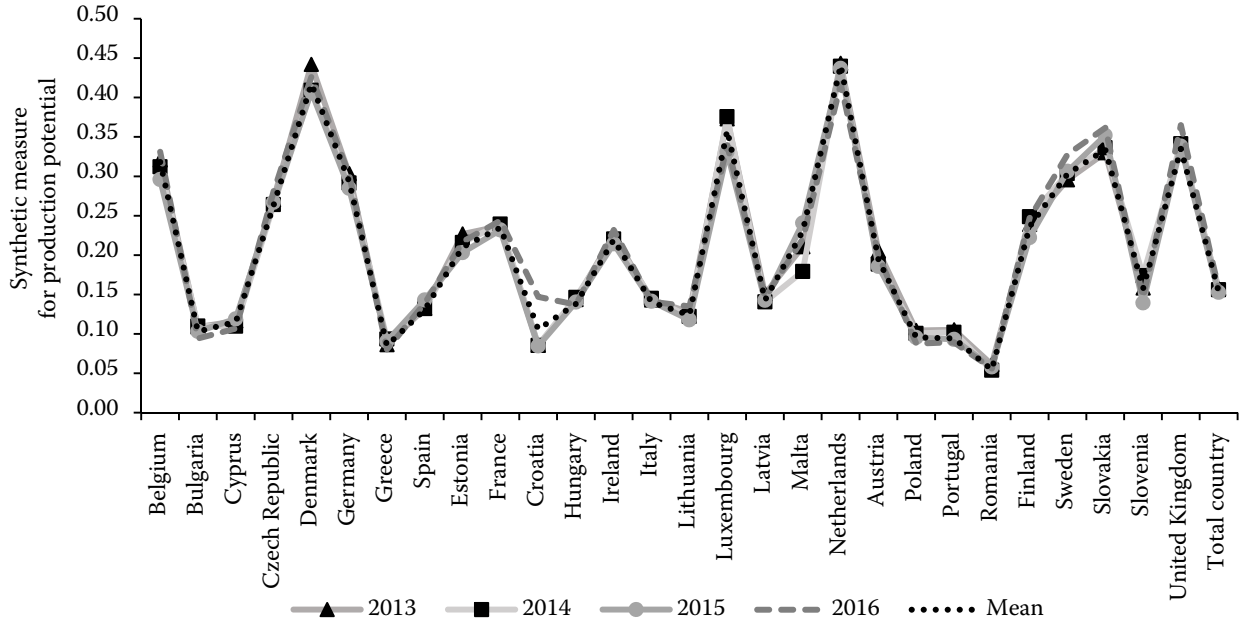

Figure 1. Values of synthetic measure expressing the production potential of farms in the EU member states in 2013–2016

Source: own study based on the EU FADN Database (2018)

were identified based on the applied measure. The first group with the highest efficiency of utilisation of the production factors included the Netherlands, Denmark, Belgium, and Luxembourg. Denmark was characterised by the highest workforce productivity (X_9) among the member states, which is also supported by studies carried out by Blaas (2004). This was an effect of relatively high production intensity and the highest level

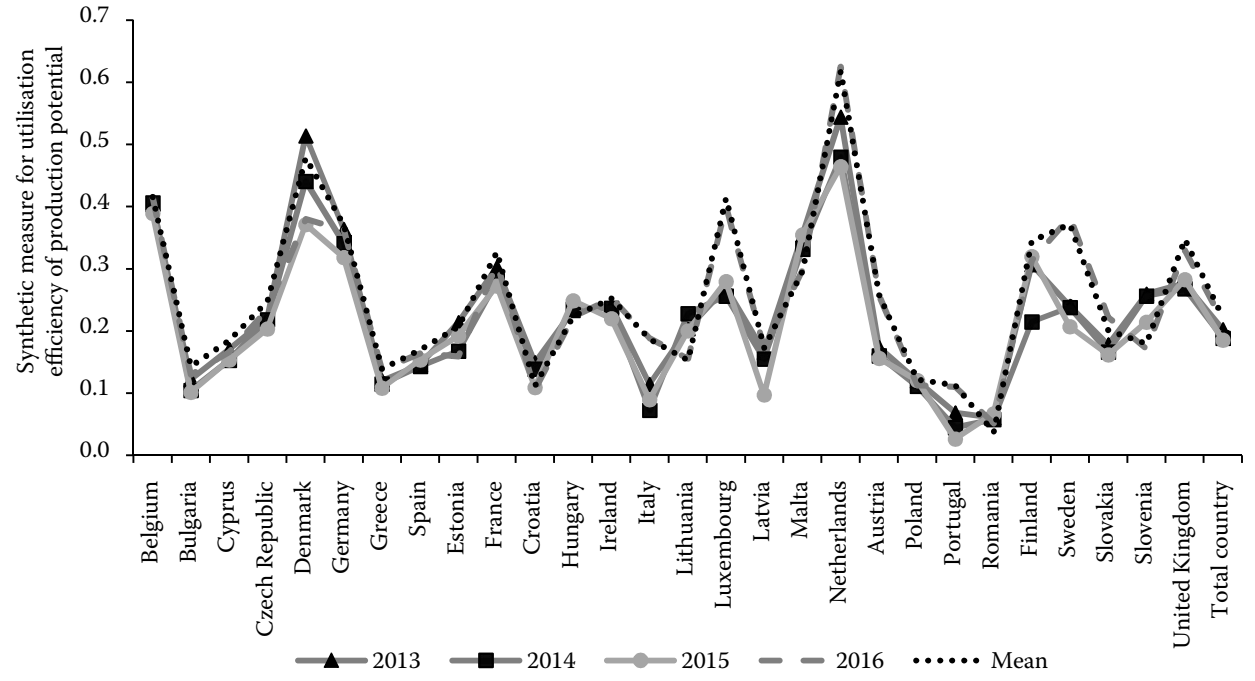

Figure 2. Values of synthetic measure expressing the utilisation efficiency of the production potential of farms in the EU member states in 2013–2016

Source: own study based on the EU FADN Database (2018)

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Table 4. Ranking of EU member states according to synthetic measures expressing the production and economic results of farms (on average in 2013–2016)

Class	Value of synthetic measure (m_i)	Country	Ranking
I	0.8316	Netherlands	1.
	0.5060	Belgium	2.
	0.5000	Denmark	3.
II	0.4356	Germany	4.
	0.3973	United Kingdom	5.
	0.3855	Luxembourg	6.
	0.3768	France	7.
	0.3757	Czech Republic	8.
	0.3679	Slovakia	9.
	0.3656	Italy	10.
	0.3467	Sweden	11.
	0.3166	Malta	12.
III	0.2853	Spain	13.
	0.2662	Finland	14.
	0.2521	Austria	15.
	0.2501	Hungary	16.
	0.2493	Ireland	17.
	0.2454	Greece	18.
	0.2119	Portugal	19.
	0.1928	Cyprus	20.
	0.1882	Estonia	21.
	0.1875	Latvia	22.
	0.1678	Bulgaria	23.
	0.1605	Lithuania	24.
	0.1567	Poland	25.
	0.1518	Croatia	26.
IV	0.1509	Slovenia	27.
	0.1391	Romania	28.

Source: own study based on the EU FADN Database (2018)

of technical resources (X_2) among the member states. In turn, Luxembourg recorded the maximum value of variable X_{10}. The second group is formed by eight member states, of which only one (Malta) is a new member state of the EU. An average level of potential utilisation efficiency was characteristic of 12 member states, and only three of them were old member states. Member states which utilised the potential least efficiently were Poland, Portugal, Croatia, and Romania. The latter was characterised by the lowest workforce productivity (X_9) among member states. Studies by Popescu (2015) showed that the main problem related to low productivity of agriculture in Romania is an unfavourable structure of farms, low level of technical resources in agriculture, investments and education of farmers as well as climatic changes having an adverse influence on production results. Analysing the values of measure m_i in respective years, a clear increase in production potential utilisation efficiency can be observed in a few member states. This mainly concerns Italy, Luxembourg, Portugal, Sweden and Austria (Figure 2).

The production and economic results of EU member states were also evaluated. The synthetic measure was developed based on four variables, i.e. value of production per 1 farm, average income per farm, net value added per 1 AWU and crop production per 1 ha of UAA. The first class of member states with the best results included the Netherlands, Belgium and Denmark (Table 4). All those countries also formed the first class of member states both in terms of the production potential and the efficiency of its utilisation. The second class comprised 9 member states, including Malta and Luxembourg that play no significant role in EU agriculture. According to Database EUROSTAT (2018), in 2016 the share of agricultural production of those member states in the EU production was respectively 0.03 and 0.09%. The third class consists of 14 member states in which the synthetic measure ranged from 0.28 in Spain to 0.15 in Croatia. Countries with the lowest measure m_i were Slovenia and Romania. The first of the countries mentioned above had the lowest level of average income per farm and the net value added per 1 AWU among all the member states of the EU. However, in Romania, the lowest average value of production in the EU per 1 farm was noted. Figure 3 shows that the largest changes in production and economic results were observed for Slovakia and Denmark at the turn of 2013–2016.

Comparing the rankings regarding the three analysed groups of variables, it can be observed that some member states are ranked in the same class in each of them. For instance, class I invariably comprised the Netherlands and Denmark. However, for certain member states, the relatively high ranking position of the production potential was accompanied by a much lower ranking position of production and economic performance (e.g. Slovakia). The disparities testify to incomplete utilisation of the potential, and they

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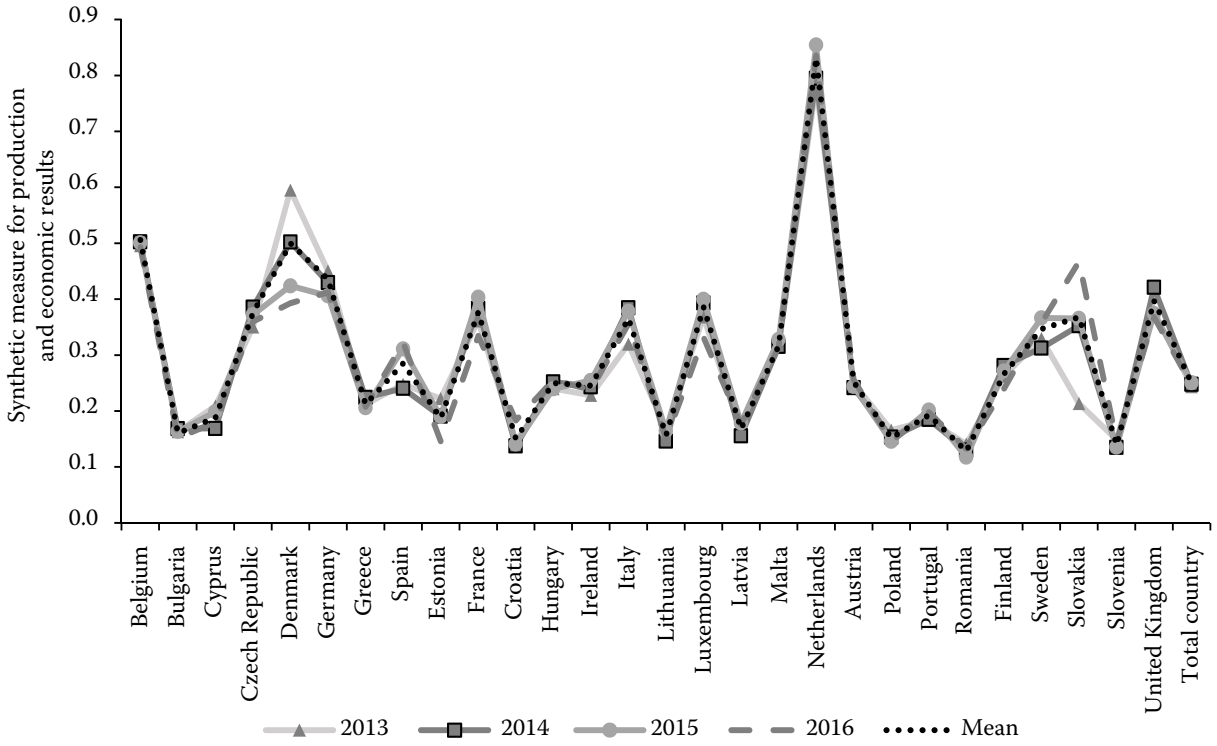

Figure 3. Values of the synthetic measure expressing the production and economic results of farms in the EU member states in 2013–2016

Source: own study based on the EU FADN Database (2018)

point to the need for searching the sources of improvement in performance.

CONCLUSION

The paper evaluated the differentiation of the production potential of farms in the member states of the European Union and the efficiency of its utilisation in 2013–2016. The calculation of the synthetic measure based on a number of variables allowed creating a ranking of the member states based on their level of the production potential of farms. Countries such as the Netherlands, Denmark, Luxembourg, the United Kingdom, Slovakia and Belgium were characterised by the highest potential. However, the competitiveness of farms is determined not only by their production potential but also by the efficiency of its utilisation. Surveys demonstrated that the Netherlands, Denmark, Belgium and Luxembourg were countries that were the best in terms of both. It was also shown that in the case of certain countries the potential places them among the best member states, but with regard to relatively worse efficiency, they are classified in a lower group. The low and average level of both analysed features was characteristic of farms in most of the new member states. One reason for the low efficiency of utilisation of the production potential in certain new member states of the EU is an unfavourable structure of farms. However, on the other hand, small farms play a very important role in sustainable development of rural areas through multi-functional agriculture, ensuring biological diversity and development of agriculture. At the same time, large farms ensure better efficiency of the involved production factors (Burja and Burja 2016).

This study contributes to reference literature concerning the evaluation of the production potential and production factors management efficiency of farms for two reasons. Firstly, the subjective scope of the study is the community of 28 EU member states. According to the authors, studies with such a subjective scope have been rare up to now. Secondly, this study attempts to fill the gap in surveys concerning the spatial differentiation of agriculture in the European Union. Significantly, the evaluation of both the production potential and its efficiency made use of a number of variables based on which the synthetic measure was developed. It enabled a more comprehensive evalu-

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ation of the analysed phenomena than applying only one selected criterion, which is common in reference literature. Thus, countries characterised by the highest and the lowest production potential and the best and the worst efficiency level could be identified.

The surveys have not exhausted the options for evaluating the differentiation of the production potential and its management efficiency in agriculture of the member states of the European Union. The results of the study form the basis for further surveys taking into account a wider range of variables characterising the production potential and efficiency of its utilisation. It seems that the identification of factors shaping the efficiency of management and the evaluation of related convergence processes between member states should be an important direction in further works.

REFERENCES

Barthelemy D., David J. (eds) (2001): Production Rights in European Agriculture. INRA Editions, Elsevier, Amsterdam: 197.

Blaas G. (2004): Productivity of factors in the enlarged EU. Agricultural Economics – Czech, 50: 509–513.

Bryden J. (2002): Rural development indicators and diversity in the European Union. In: Proceedings of Conference Measuring Rural Diversity. Washington, DC.

Burja C., Burja V. (2016): Farms size and efficiency of the production factors in Romanian agriculture. Economics of Agriculture, 63: 361–374.

Byerlee D., de Janvry A., Sadoulet E. (2009): Agriculture for development: Toward a new paradigm. Annual Review of Resource Economics, 1: 15–31.

Ciutacu C., Chivua L., Andrei J.V. (2015): Similarities and dissimilarities between the EU agricultural and rural development model and Romanian agriculture. Challenges and perspectives. Land Use Policy, 44: 169–176.

Christiaensen L.J., Swinnen J. (1994): Economic, institutional and political determinants of agricultural production structures in Western Europe. Working paper 11. Department of Agricultural Economics, Catholic University of Leuven, Leuven.

Database EUROSTAT (2018): Database EUROSTAT. Available at https://ec.europa.eu/eurostat/data/database (accessed Sept 20, 2018).

EU FADN Database (2018): EU FADN Database. Available at http://ec.europa.eu/agriculture/rica/ (accessed Sept 20, 2018).

Giannakis E., Bruggeman A. (2015): The highly variable economic performance of European agriculture. Land Use Policy, 45: 26–35.

Kreneva S., Halturina E., Larionova T., Shvetsov M., Tereshina V. (2015): Influence of factors of production on efficiency of production systems. Mediterranean Journal of Social Sciences, 6: 411–418.

Latruffe L. (2010): Competitiveness, productivity and efficiency in the agricultural and agri-food sectors. OECD Food, Agriculture and Fisheries Working Papers, No. 30. OECD Publishing.

Leń P., Skrzypczak I., Oleniacz G., Mika M. (2017): The use of statistical methods for the evaluation of land adjustment proposals and elimination of the patchwork pattern of land ownership. In: Čygas D., Vaiškūnaitė R. (eds): Proceedings Environmental Engineering 10th International Conference Vilnius Gediminas Technical University, Vilnius, April 27–28, 2017: 1–6.

Matyja M. (2016): Resources based factors of competitiveness of agricultural enterprises. Management, 20: 368–381.

Neuenfeldt S., Gocht A., Heckelei T., Ciaian P. (2018): Explaining farm structural change in the European agriculture: a novel analytical framework. European Review of Agricultural Economics, jby037: 1–56.

Nowak A., Janulewicz P., Krukowski A., Bujanowicz-Haraś B. (2016): Diversification of the level of agricultural development in the member states of the European Union. Cahiers Agricultures, 25: 55004.

Pawlewicz A., Pawlewicz K. (2018): Regional differences in agricultural production potential in the European Union Member States. In: Proceedings of the 2018 International Conference Economic Science for Rural Development, No. 47, Jelgava, LLU ESAF, May 9–11, 2018: 483–489.

Poczta-Wajda A., Poczta J. (2016): The role of natural conditions in qualified agritourism – case of Poland. Agricultural Economics – Czech, 62: 167–180.

Popescu A. (2015): Research on labour productivity in Romania's agriculture. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 15: 271–280.

Siudek T., Zawojska A. (2014): Competitiveness in the economic concepts, theories and empirical research. Acta Scientiarum Polonorum, Oeconomia, 13: 91–108.

Vavřina J., Basovníková M. (2015): Competitiveness of family farms in the Czech Republic in the context of EU Common Agricultural policy 2014+. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 63: 2171–2178.

Received December 14, 2018
Accepted March 11, 2019