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DIVERSITY OF FADN MILK FARMS IN THE REGIONS OF THE EUROPEAN UNION IN 2011[1]

ZRÓŻNICOWANIE GOSPODARSTW MLECZNYCH FADN W REGIONACH UNII EUROPEJSKIEJ W 2011 ROKU

Key words: diversity, FADN milk farms, milk production, regions of the European Union, cluster analysis

Słowa kluczowe: zróżnicowanie, gospodarstwa mleczne FADN, produkcja mleka, regiony Unii Europejskiej, analiza skupień

Abstract. The aim of the paper was to show the diversity of FADN dairy farms by presenting standard deviations and Gini coefficients of main features describing these farms in 2011 in relation to 2004. It was considered that the level of differentiation of surveyed households increased, so there was cluster analysis used in order to find regions with the majority of households with similar characteristics, i.e. similar total utilized agricultural area, an alike number of dairy cows with similar milk yield. On this basis there were three typological groups carried out – with a predominance of intensive production, extensive production and "milk factories". It should be noted that despite the inclusion of all countries in the same instruments of support under the CAP, the division for more efficient production in Western Europe and extensive in the countries of Central and Eastern Europe is still visible.

Introduction

The European Union is characterized by diversity on many levels, among which as one of the first man mention agriculture [Matuszczak 2012]. Beside independent of man's will diversity of the soil, climate and nature factors there are also differences in the level of production and economic indicators of farms [Grontkowska 2012]. In the case of milk production, scale production plays important role in shaping economic indicators differences [Parzonko 2006, Świtłyk, Ziętara 2008, 2012, Seremak-Bulge 2011]. The structure of agriculture in the various countries of the present European Union is largely conditioned by their history. According to Poczta, Sadowski and Średziński [2008], structural changes took a different course in the eastern and western parts of the European Union. The countries of Central and Eastern Europe have undergone a post-war process of collectivization that led directly to the formation of large enterprises, whose fate after a period of structural changes was dependent on the ownership transformation path adopted in the country. In Western Europe concentration of production processes were forced by the market situation. Therefore, it seems to be interesting to analyze differences in terms of the economic and production results of milk farms in the regions of the EU due to the large internal differences, in particular in the context of the implementation of reforms involving milk quota abolition.

The diversity of FADN dairy farms in the regions of the European Union

About persistent and even increasing diversification of production and economic indicators of FADN dairy farms in the regions of the European Union provide increased standard deviation in 2011 in relation to 2004 for most of the variables examined for both the 108 macro-regions and for the 94 macro-regions (without taking into account macro-regions in Bulgaria and Romania.

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The latest inclusion into the regulation mechanisms of the EU milk market and the backwardness of the local farms in relation to more developed Member States could significantly affect the value of standard deviation).

In 2011 the value of production of milk and milk products in FADN milk farms amounted to an average of EUR 149,205.30, in all regions of the European Union, but the standard deviation was higher than the average and amounted to EUR 156,013.57. Such high deviation values indicate a large variety of valuable production in the European Union. For 94 regions, after exclusion of Bulgarian and Romanian regions, the value of production was much higher and amounted to an average of EUR 170,009.36 and deflected from this value by an average of EUR 156,927.92, representing 92.31% of the average. In 2004 the average value of production of milk and milk products amounted to EUR 108,917.00 with a standard deviation level of EUR 85,669.16, representing 78.66% of the average.

The impact of the valuable approach, however, have also foreign exchange differences, therefore it was decided to present other features characterizing FADN dairy farms in the regions of the European Union. The average economic size of dairy farms in FADN regions of the EU 2011 increased from 73.19 ESU recorded in 2004 to 181.68 ESU in 2011 (207.05 ESU excluding Bulgarian and Romanian regions). This may indicate outlining of a clear distinction between extensive – grazing and intensive – alcoves breeding.

A similar situation occurred in the case of the number of dairy cows and their milk yield. Despite a slight increase in the average, standard deviation increased significantly (from 39.29 LU representing 72.28% of the average in 2004 to 54.68 LU corresponding to 93.47% of the average in 2011 – 64.90 LU representing 83.36% of the average for the regions with the exception of Bulgarian and Romanian farms) in case of milk yield it increased from 1,196.48 kilo/cow in 2004 to 1763.89 kilo/cow in 2011 – 1,394.92 kilo/cow without taking into account Bulgarian and Romanian regions.

However, the standard deviation of economic size of farms increased significantly from 63.77 ESU (87.13% of the average) in 2004 to 214.45 ESU (118.04% of the average) in 2011 (excluding the Bulgarian and Romanian regions – 218.83 ESU representing 105.70% of the average). This might suggest that the diversity of farms in terms of economic size in the regions of the European Union increased in 2011 compared to 2004.

The average area of utilized agricultural area slightly increased from 76.03 hectares in 2004 to 89.7 ha in 2011. As in previous cases the standard deviation increased from 91.09 hectares in 2004 to 140.24 ha in 2011 (respectively from 119.80% to 156.34% of the average). After exclusion of Bulgarian and Romanian regions the increase of the average land area proved to be significant – of 76 hectares in 2004 to 102 hectares in 2011. The standard deviation amounted to 146.5 hectares and represented 143.78% of the average. This may indicate outlining a clear distinction between breeding extensive and intensive grazing alcoves. A similar situation occurred in the case of the number of dairy cows and their milk production. Despite a slight increase in the average, standard deviation increased significantly (from 39.29 LU representing 72.28% of the average in 2004 to 54.68 LU corresponding to 93.47% of the average in 2011 (64.90 LU representing 83.36% of the average for the regions without of Bulgarian and Romanian farms) where the number of dairy cows from 1,196.48 kilo/cow in 2004 to 1763.89 kilo/cow in 2011 (1,394.92 kg/cow without taking into account Bulgarian and Romanian regions).

There were no significant changes seen in the case of share of rented land in the utilized agricultural area. It may indicate a lack of interest in the lease of additional land, which also affected a stable indicator of land area per cow. The average value of total costs per 1 ESU has been however reduced. In 2004, it amounted to 1,969.23 EUR, while in 2011 it fell to 1,098.31 EUR (1,125.24 excluding the Bulgarian and Romanian regions). This may demonstrate improvement of production organization and the completion of modernization projects affecting the level of costs. Also the standard deviation of this variable was reduced significantly from 892.29 EUR (45,31% of the average) to 269.77 EUR (24.56% of the average) and 269.30 without including Bulgarian and Romanian regions, which accounted for 23.93% the average value.

In 2011 in relation to 2004 the level and diversity of subsidies (except subsidies for investments) EUR per 1 ESU and deviated from the average value of ± 376.48 EUR, while in 2011 the level dropped to 216.96 EUR per ESU and standard deviation was 114.78 EUR (excluding Bulgarian and Romanian regions – 76 EUR per 1 ESU with a standard deviation at 120.61 EUR). This means that both in the case of the whole set of regions, as in the case of corrected set of regions without Bulgaria and Romania, the standard deviation increased. It may be a prerequisite for finding the growth of the existing diversity of European Union dairy farms by region.

The increased degree of differentiation FADN dairy farms in the regions of the European Union may be also provided by a rise in the value of the Gini coefficient for the main features of the tested farms. The increase in the value of the Gini coefficient means an increase in variable distribution inequality, and thus increase the diversity of the feature. Gini coefficient relating to the milk production in the macro-regions of the European Union increased from 0.377 in 2004 to 0.485 in 2011 (0.421 excluding the regions of Bulgaria and Romania). A similar increase was observed in the case of utilized agricultural area, economic size and the number of dairy cows, where the Gini coefficient grew for all the regions and without taking into account Bulgarian and Romanian regions. This may mean that there is a clear distinction between intensive production of high concentration and extensive with the dominance of grassland breeding.

The uneven distribution also increased in case of milk yield per cow in all the regions of the European Union. This may be related to the enlargement of the European Union of new members and persisting difference in the milk yield of cows in the EU-15 and EU-12. This increase, however, was negligible after the rejection of Bulgarian and Romanian regions. In connection to the existing diversity it was considered that the determinants of milk production in the regions of the European Union may vary depending on the economic size, the number of dairy cows, utilized agricultural area and milk yield.

Classification of FADN dairy farms in the regions of the European Union in 2011

There was cluster analysis performed. Typology was based on three of the first four selected features from the FADN field of observation, describing tested farms, i.e. utilized agricultural area, the number of dairy cows and the average annual milk yield. The economic size was discarded from the analysis due to too high correlation with other features. Grouping of farms was made using the hierarchical method.

Among the possible techniques the agglomeration procedure was used. The distances between clusters arising from the combined objects are defined using the Ward's method. Using this procedure there have been 3 groups of regions in which dairy farms are characterized by similar features listed. The solution (separability of clusters in terms of observed characteristics) was checked by the Silhouette indicator S (i), which amounted to 0.51 and exceeded the required critical level. It can be concluded that the formed clusters are disjoint from the studied traits, therefore qualify for the correctness of made-sharing within the cluster analysis.

As a result of the cluster analysis of the 108 regions three type of regions (internally homogeneous groups) were obtained:

– 1st typological group, covering 60 regions, including the vast majority of regions of the EU-15 and the Czech Republic, Estonia, Malta and Hungary Nyugat-Dunántúl,
– 2nd typological group, consisted of five regions of northern and central Germany and Slovakia.
– 3rd typological group, covering 42 regions with a majority of regions of the EU-12 and Italian regions, three Spanish regions (Asturias, Cantabria and the Balearic Islands), two French (Auvergne and Languedoc-Roussillon), the Portuguese Azores, Ireland and Austria.

The obtained clusters grouped regions, where dairy farms are characterized by a similar utilized agricultural area, a similar number of dairy cows and the average annual milk yield. This resulted in a groups with predominance of:

– intensive milk production – 1st typological group (economic size on an average of 192.53 ESU, a relatively large area of agricultural land (80.43 hectars) and number of dairy cows (63.91 pcs.) and milk yield at a medium level of more than 7560 kilos per year).
– „milk factories" – 2nd typological group (950.07 ESU on average, with the largest area of agricultural land (598.06 hectars) and the number of cows (nearly 250 cows per farm) and the highest annual milk yield – almost 8000 kg per year (excluding Slovakia which significantly underestimating the result of other regions – more than 8,500 kg per year).
– extensive milk production – 3rd typological group (an average of 56.40 ESU, agricultural area of 30 hectares, and about 25 dairy cows with productivity at the level of 4638 kilos per year).

In the cluster with predominance of intensive milk production concentrated in large farms (1st typological group) and very large – "milk factories" (2nd typological group) the relatively wealthier regions of the EU-15 countries v. In the group of regions with a predominance of very large dairy farms, defined as "milk factories" beside prosperous German regions, where the average dairy farm's economic size exceeding to 1000 ESU, there was also Slovakia with very large farms characterized by much lower efficiency, what is characteristic of remaining in poor condition agricultural economies in post-socialist countries. However, among the groups of predominantly extensive production of milk (3rd typological group) regions of the EU-12 countries strongly dominated.

The largest share of rented land in utilized agricultural area was noted in the group of predominantly „milk factories" (2nd typological group) and amounted to 86%, while the smallest share at about almost 63% was observed in the group of predominantly extensive production (3rd typological group). The high share of renting in the second typological group may be due to good

Table 1. Average values of selected dairy farms characteristics by cluster using FADN regions of the European Union in 2011
Tabela 1. Wartości średnie wybranych cech opisujących gospodarstwa mleczne FADN w skupieniach regionów Unii Europejskiej w 2011 roku

Specification/*Wyszczególnienie*	Cluster/*Skupienie*		
	I	II	III
Economic size/*Wielkość ekonomiczna [ESU]*	192,53	950,07	56,40
Total Utilised Agricultural Area (UAA)/*Powierzchnia* użytkowanych użytków rolnych *(UR) [ha]*	80,43	598,06	30,34
Share of rented UAA/*Udział gruntów dzierżawionych w powierzchni UR [%]*	67,50	86,00	62,75
Milk cows/*Krowy mleczne [LU]*	63,91	241,405	24,65
Other cattle/*Pozostałe bydło [LU]*	42,45	161,68	12,13
Milk yield [kg/cow]/*Wydajność mleczna [kg/krowę]*	7 561,09	7 993,31 8 508,53*	4 638,42
UAA [ha/cow]/*Powierzchnia UR [ha/krowę]*	1,26	2,48	1,23
Total labour input/*Nakłady pracy ogółem [AWU]*	2,30	14,24	1,83
Unpaid labour input/*Nakłady pracy własnej [FWU]*	1,65	1,14	1,47
Paid labour input/*Nakłady pracy najemnej [AWU]*	0,65	13,10	0,36
Share of paid labour input in total labour input/*Udział pracy najemnej w nakładach pracy ogółem [%]*	28,11	91,97	19,90
Farm net value added per full employed person/*Wartość dodana netto na osobę pełnozatrudnioną [EUR/AWU]*	36 903,85	24 260,56	16 560,25
Total cost per ESU/*Koszty w przeliczeniu na 1 ESU*	1 141,23	1 531,49	975,12
Total subsides (excluding on investments) per 1 ESU/*Poziom dopłat (bez inwestycji) w przeliczeniu na 1 ESU [EUR]*	212,38	272,32	215,59

* without Slovakia/*bez Słowacji*
Source : own research based on [http://ec.europa.eu, access 20.11.2014]
Źródło: badania własne na podstawie [http://ec.europa.eu, 20.11.2014]

organization of farmers and convenient horizontal legal regulations of land lease in Germany. Considering utilized agricultural area per cow the highest values obtained in the regions with a predominance of very large farms – "milk factories" (2.48 ha per cow). It should be noted that the majority of these farms produce their own feed, hence such a high rate.

The biggest total labour input was recorded in regions with very large farms and amounted to 14.24 AWU, while the lowest total workload was observed in the group of predominantly extensive production (1.83 AWU). It was only slightly lower than in the regions with a predominance of intensive production (2.30 AWU) despite almost three times the number of dairy cows and economic size. The largest share of paid labour input in the total labour input was performed in the group of predominantly "milk factories" (2nd typological group) and amounted to almost 92%, and the minimum in the group of predominantly extensive production – 19,90%. The largest net value added per person fully employed (EUR 36,903.85) farms in the regions of 2nd group reached, and the smallest (EUR 16,560.25) – farms from the regions where extensive production prevailed. The biggest total costs per 1 ESU amounting to an average of EUR 1,531.49 were recorded in regions with a predominance of milk factories, and the smallest (on average EUR 975.12) in the group of predominantly extensive production (3rd typological group). In contrast, the lowest average level of subsidies without investments per 1 ESU among the respondents (339.28 EUR) was identified in the regions with a predominance of intensive production (1st typological group). The most effective in subsidies acquiring were very large farms in the regions of typological group, reaching the average level of 272.32 EUR per 1 ESU.

Conclusions

The diversification of dairy farms in the regions of the European Union in 2011 increased in comparison to the state in 2004 for both all 108 regions and 94 regions without Bulgarian and Romanian regions. It is evidenced by the increase in the value of the Gini coefficient and standard deviation values for the main features describing studied farms. This may mean that it produces a clear distinction between intensive production of high concentration and extensive with predominance of the grassland breeding. In the cluster of predominantly intensive milk production concentrated in large farms and very large the relatively wealthier regions of the EU-15 countries dominated. However, among the group of predominantly extensive milk production regions in the EU-12 countries, which confirms the polarization of European milk production, definitely dominated.

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Streszczenie

Celem badań było ukazanie zróżnicowania gospodarstw mlecznych FADN poprzez przedstawienie odchyleń standardowych i współczynników Giniego w 2011 roku w odniesieniu do roku 2004. Uznano, że poziom zróżnicowania badanych gospodarstw wzrósł, dlatego zastosowano analizę skupień w celu odnalezienia regionów z przewagą gospodarstw o podobnych cechach, tj. podobnym areale użytków rolnych, zbliżonej liczbie krów mlecznych o podobnej mleczności. Na tej podstawie wyróżniono trzy grupy typologiczne – z przewagą intensywnej i ekstensywnej produkcji oraz tzw. „fabryk mleka". Pomimo objęcia wszystkich krajów tymi samymi instrumentami wsparcia w ramach WPR, wciąż widoczny jest podział na bardziej efektywną produkcję w Europie Zachodniej i ekstensywną w krajach Europy Środkowej i Wschodniej.

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