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Determinants of milk production in FADN dairy farms in the regions of the European Union with predominance of intensive production in 2011[1]

1. Introduction

The European Union is characterized by diversity on many levels, among which as one of the first man mention agriculture (Matuszczak 2012, pp. 156 – 174). 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, pp. 58-69). Increased values of the standard deviation and the Gini coefficient in 2011 in relation to 2004 for most variables from the field of FADN observation data base provide persistent, and even increasing diversity of economic and production indicators of FADN dairy farms in the regions of the European Union (Guth 2015, pp. 119-124). In the case of milk production the most important role in shaping differences in economic indicators plays production scale. This is confirmed by the study of many economists specializing in the deliberations on the milk market - Parzonko A. (2006,

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pp. 83-91), W. Ziętara (2003, 2006, 2010), M. Świtłyk and W. Ziętara (2008, 2012) J. Seremak-Bulge (2011), A. Wojcik (2010, 2012) and R. Sass (2007). The larger the production scale of the farms is, the higher incomes, productivity and profitability of land and higher fee work they reach. Another reason for diversification may be different course of structural transformations in the eastern and western parts of the European Union (Poczta, Sadowski and Średzińska 2008). These factors indicate that the determinants of milk production may vary significantly by region in the European Union.

The purpose of this article was to identify determinants of milk production in dairy farms in the macro-regions of the European Union with a predominance of intensive milk production in 2011, recognized as the most perspective after the liquidation of milk quotas.

2. The classification of FADN dairy farms in the regions of the European Union in 2011

In connection with the statement of growth of differentiation among FADN dairy farms in macro-regions of the European Union in 2011 in relation to 2004 (Guth 2015), it was decided to conduct a study of the factors having the greatest impact on the production of milk in 2011 in different groups of regions with similar farms. There was cluster analysis performed. Typology was based on three of the first four selected features from the FADN field of observation, describing the examined farms, i.e. the utilized agricultural area, number of dairy cows and the average annual milk yield of cows. The economic size of farms was rejected from the analysis due to too high correlation with other traits. Grouping was performed using hierarchical method. Among the possible techniques there was the agglomeration procedure used. The distance between the clusters that had arisen from the combined facilities were determined using the method of Ward. Solution was checked by Silhouette indicator (separability of clusters in terms of the studied traits) S (i), which was 0.51 and exceeded the required critical level. It can therefore be concluded that the distinguished groups are disjoint from the studied traits, so the solution qualify for the correctness of the distribution made in the context of cluster analysis. As a result of the cluster analysis of the 108 regions analyzed there were three internally homogeneous groups obtained with predominance of:

- intensive milk production - I typological group, consisting of 60 regions, including the majority of regions in the EU-15 and the Czech Republic, Estonia, Malta and Hungarian Nyugat-Dunántúl (an average of 192.53 ESU, a relatively

large area of agricultural land (80.43 ha) and number of dairy cows (63.91 pcs.) and milk yield at an average of more than 7560 kg per year),
- 'milk factories' - II typological group, which accounted for five regions of northern and central Germany, and Slovakia (an average of 950.07 ESU, the largest area of agricultural land (598.06 ha) and the number of cows (nearly 250 cows per farm) and the highest annual milk yield - almost 8000 kg per year (excluding Slovakia significantly underestimating the result of other regions - more than 8,500 kg per year) [2],
- extensive milk production - III typological group, consisting of 42 regions, with predominance of regions from the EU-12 (an average of 56.40 ESU, with an area of agricultural land of 30 hectares, with an average of about 25 dairy cows and annual milk yield of 4638 kg per year).

The clusters of predominantly intensive milk production concentrated in large farms (group typological) and very large - "milk factory" (group II typological) prevailed relatively prosperous regions of EU-15 countries. Among groups of predominantly extensive production of milk (III typological group) strongly dominated regions of the EU-12. In view of the observed diversity of FADN dairy farms in the regions of the European Union, it was considered that the determinants of milk production may vary in the resulting clusters. Therefore, it was decided to carry out factor analysis within distinguished by the cluster analysis groups. This study covers regions with a predominance of intensive production.

3. Determinants of milk production in macro-regions of the European Union with a predominance of intensive milk production

The starting point was to create a matrix of observation, which was a collection of 49 FADN indicators that illustrate various features of the dairy farms in the macro-regions of the European Union with a predominance of intensive milk production in 2011. Variables were standardized. The analysis of the correlation of variables showed that there are some important compounds, characterized by high complexity. There was a method of grouping of variables based on the criterion of maximum correlation used. In terms of factor analysis, the

2 Due to the nature of privatization in Slovakia there were large farms built, which were owned by several owners, companies or cooperatives. Although the ownership structure is conducive to the production of milk (as in production by increasing economies of scale), it should be noted that the standard of local farms significantly differs from modern farms in Germany. These differences, along with differences in the quality of feed have a significant impact on the milk yield of cows.

determinants of milk production in the European Union macro-regions with a predominance of intensive production in 2011 was determined using the 34 features selected from 49 analyzed indicators. In the case of the surveyed population of dairy farms in the macro-regions with a predominance of intensive milk production on the basis of sufficient proportions (over 75% of the explained variance) and scree chart analysis there were 3 independent factors extracted, which explained more than 75% of the stock of common (cumulative) variation (see: table 1).

Table 1. Factor solution for regions with a predominance of intensive milk production

Factor	Self-value of correlation matrix	Share in the use of variation (in %)	
		common	cumulative
F_1	11.99	31.55	31.55
F_2	9.10	23.94	55.49
F_3	7.42	19.52	75.01

Source: own study based on the results of own research using FADN data for the "dairy cows" type of production by region in 2011

In order to narrow the scope of the factors and standardize their nature, the solution was subjected to the procedure of rotation, using for further analysis solution obtained using the analytical method Varimax - raw version. As the leading factor there should be considered the first factor (F1), because it explains the largest resource of common variation (31.55%). The smallest resource of the common variation explained third factor (F3), which means that it conditioned the milk production for smallest scale of these three highlighted factors. It should be recognized, however, that its share in explaining the variation of the production was significant and amounted to 19.52% (see: table 1).

3.1. The price-cost relationships in dairy farms from the regions of the European Union with a predominance of intensive milk production in 2011 (F_1)

The factor of greatest concern were the price-cost relationships. In the structure of features forming factor F1 predominate factors related to costs (9 out of 13

traits). It was recognized, however, that prices indirectly affect both the costs and resources in the surveyed farms, because of their height and relations to the costs, farms take decisions on the scale and type of production, which justified the name above.

Table 2. Price-cost relationships in farms in the regions of the European Union with a predominance of intensive milk production in 2011 (construction of factor F_1)

No.	Name of characteristics	Factor load
1.	Farmhouse consumption	0.86612
2.	Beef and veal	0.73277
3.	Farm use	0.70379
4.	Direct costs	0.71016
5.	Share of feed for grazing livestock in direct costs	0.72902
6.	Share of home grown feed for grazing livestock in total amount of feed for grazing livestock	0.86443
7.	Wages paid	0.79701
8.	Interest paid	0.83955
9.	Current assets	0.70177
10.	Fixed assets	0.72070
11.	Short-term loans	0.83071
12.	Long-term liabilities	0.84120
13.	Subsidies on external factors	0.73966

Source: own study based on data from FADN

The structure of features forming factor F_1 and their assigned weights indicate that the price and cost relationships in dairy farms from the regions of the European Union with a predominance of intensive milk production in 2011 were conditioned mostly by farmhouse consumption, understood as the value of plant and animal products produced and used in farm operating activities, e.g. for animal feed, as well as liabilities in total, of which to more extent by long-

term liabilities (see: tab. 2). There should be the high importance of the share of feed for grazing livestock in direct costs noted and the high impact of share of home grown feed for grazing livestock in total amount of feed for grazing livestock on price-cost relationships. It can therefore be concluded that farms erode the risk of feed prices rising through their partial production on the farm. It is worth noting that the high impact on the price-cost relationships in farms from the regions with a predominance of intensive production had interest paid, including interest and financial charges paid for the loans taken for the purchase of land, buildings, machinery and equipment, animals and materials, as well as interest and financial charges for the liabilities. This means that the farms in regions with a predominance of intensive milk production carry a lot of investment to modernize and improve its production, seeing in it a chance for further development (see: tab. 2). Significant impact on the price-cost relations in farms in the regions with a predominance of intensive milk production next to costs had also subsidies on external factors. The costs of external factors are defined as the costs of involvement of foreign factors of production (labor, land and capital) in the production process. Of great importance for the relation price and cost were also held total assets (defined as the sum of the fixed and current assets), including in particular the fixed assets, consisting of agricultural land, buildings, farm, planting forests and machinery and equipment, as well as the animals the basic herd and fixed assets that are in the investment phase.

As the result of conducted analysis there was comparative scale designed, starting with the regions with the best price-cost relationships to the "worst" of the factor value. The best price-cost relationships occurred in the Czech Republic, Scotland and the English regions of England-East and England-West, French Champagne-Ardenne, Picardie and Bourgogne and German Schleswig-Holstein. It was certainly an effect of relatively better than on average in the European Union natural conditions for milk production occurring in these regions. The lowest values obtained in Spanish Galicia, the Italian regions - Trentino, Puglia, Veneto and Sardinia and the Portuguese Norte e Centro. It is therefore concluded that the less favorable price-cost relationships among milk farms in the regions with a predominance of intensive production occurred in the countries of southern Europe, characterized by a lack of natural pastures and relatively more difficult natural conditions for milk production. At the same time, it should be remembered that the factor values are relative and should not be absolutized. Relatively favorable price-cost relationships occurred in the regions located in the so-called "green belt of the milk production", containing the English regions, northern and central French regions and German regions

(among the regions with a predominance of intensive milk production). Below average there were Scandinavian, Spanish and Italian regions, mountainous regions of southern France and southern Germany, where these relations have deteriorated largely due to a less favorable environment or infrastructure.

3.2. Non-productive costs of running dairy farms from the EU regions with a predominance of intensive production in 2011 (F_2)

The second factor in turn explained 23.94% of the common variation. After analyzing the components of a factor it was decided that it contains features which can be defined as non-productive costs of running dairy farms in EU regions with a predominance of intensive milk production in 2011. Among the features forming the second factor there are also three items not deductible, i.e. other cattle, beef and veal and "decoupled" payments[3]. It was concluded that maintaining the herd (not milk cows) undoubtedly affects the level of costs of dairy farms, so that the inclusion of this feature for non-production costs of running a dairy farm can be justified. With this variable there is the value of the beef and veal sold related. Analysis of the profitability of production results in making decisions related to the sale of livestock, so that this variable may indirectly reveal the propensity of farm to lower part of the costs. "Decoupled" payments undoubtedly affect the determination of the cost structure, and by the fact that the payments are "detached" from production, they can be assigned indirectly to non-productive costs of running a dairy farm in the EU regions with a predominance of intensive production in 2011. Among the features forming factor F_2 the biggest impact on not directly related to milk production costs of running a dairy farm in the macro-regions with a predominance of intensive production exert short-term liabilities, contracted for a period not exceeding one year and mainly used to finance operating activities. "Decoupled" payments had also significant influence, understood as single farm payment disconnected from production. This may mean that even in farms with intensive production subsidies have a significant impact on the level of costs. It should be noted that on the size of the costs not directly related to milk production significant impact had keeping other cattle except of dairy cows, and proceeds from the sale of cattle and veal (see: tab. 3).

3 Single area payments in the new Member States and the single farm payments in the old Member States, which are an additional support resulting from the modulation of direct payments.

Table 3. Non-productive costs of running dairy farms from EU regions with a predominance of intensive production in 2011 (construction of factor F_2)

No.	Name of characteristics	Factor load
1.	Other cattle	0,796507
2.	Beef and veal	0,706733
3.	Services	0,758656
4.	Other direct inputs	0,839008
5.	Depreciation	0,799758
6.	Rent paid	0,742905
7.	Short term liabilities	0,843822
8.	„Decoupled"payments	0,841233

Source: own study based on data from FADN

The great importance in determining not directly related to milk production costs of running a milk farm from the EU regions with a predominance of intensive milk production in 2011 had also other direct inputs, including water, insurance (excluding insurance of buildings and accidents at work, civil liability) and other direct inputs created by the operating activity of the farm, such as fees for accounting, telephone charges, depreciation, and services, understood as the cost of work done in the framework of services and the cost of renting the machinery and rents for land hire, buildings, and the cost of the lease payments (see: tab. 3).

As in the first factor regions of the European Union with farms with a predominance of intensive production were ordered starting with those with the highest not directly related to milk production costs of running dairy farms in the regions of the European Union with a predominance of intensive production, ending at the lowest. The highest costs not directly related to milk production in the regions of the European Union with a predominance of intensive production was recorded in Denmark, the Netherlands, Sweden regions of Slattbygdslan and Skogs-oh mel and Spanish Catalonia. These are the regions with a predominance of alcove breeding due to the lack of natural pastures, which makes the maintenance of cattle not very profitable. Furthermore, these are regions in countries with relatively high cost of the external services, which

further aggravate the viability relationships. Above the average there were also Swedish and Belgian regions, Estonia, four Italian regions, two Spanish regions, the Czech Republic and the regions of southern England. The lowest non-productive cost of running dairy farms in the regions of the European Union with a predominance of intensive production were observed in the French regions (Lorraine, Champagne-Ardenne, Bourgone, Picardie, Bretagne and Franche-Comté) and in the Italian Umbria. As in terms of the first factor, under the average there were the vast majority of surveyed regions (41). That means that, the values obtained by the regions with the highest non-productive costs of operating dairy farms in regions with the predominance of intensive production differ significantly from the others.

3.3. Income of dairy farms in the macro-regions of the European Union with a predominance of intensive production in 2011 (F_3)

The third factor (F_3) accounted for 19.52% of the common resource variability. The analysis of features contained in it allowed to specify that it was represented by the variables having an impact on the income of dairy farms in the macro-regions with a predominance of intensive milk production. Among the forming factor variables the biggest influence exerted a farm net income, understood as a fee for the involvement of their own factors of production (in the case of farms with legal status only of land and capital) to the operation activity of farms and the fee for the risk taken by farmer in the financial year, calculated by subtracting the balance of subsidies and taxes on investment and the cost of external factors of net value added (see: tab. 4).

Table 4. Income of dairy farms in the macro-regions of the European Union with a predominance of intensive production in 2011 (construction of factor F_3)

No.	Name of characteristics:	Factor load
1.	Farm net value added	0.803390
2.	Farm net income	0.964261
3.	Net worth	0.810942
4.	Cash flow (I)	0.907015
5.	Current assets	0.789202

Source: own study based on data from FADN

The construction of the factor F_3 shows that a significant impact on the income of dairy farms from regions with a predominance of intensive production also had cash flow I (cash flow 1), showing the ability of a farm to self-finance its activities and create savings in operating activities. Great importance for the income of dairy farms in the macro-regions with a predominance of intensive milk production had also net worth, reflecting the value of total assets reduced of the value of total liabilities. It should be noted that in the structure of this factor there had also current assets appeared, which may mean that in relation to the concluded liabilities they had a significant impact on the value of the income of dairy farms in the macro-regions with a predominance of intensive milk production in 2011 (cf. tab. 4).

As in the case of the first two factors, the design of a comparative scale for factor F_3 consisted of ordering the regions starting from those with the biggest income of dairy farms in the macro-regions with a predominance of intensive production to the "worst" relative to the factor value. The highest income of dairy farms in the macro-regions with a predominance of intensive milk production in 2011 was reported in the Italian regions - Emilia-Romana, Lombardia, Umbria and Sardinia. As for the price-cost relationships also in the case of the third factor the high results occurred in the English regions Egland East-and-West England. Above the average for a set of regions in the European Union with a predominance of intensive milk production in 2011 in terms of income of dairy farms there were the Czech Republic, the Netherlands, four Spanish regions and other English regions of and Ireland. The relatively lowest factor value of the third factor occurred in the regions of southern France - Aquitaine, Midi-Pyrénées and Rhônes-Alpes, Spanish Norte e Centro and Scandinavian regions Sisa-Suomi and Lan and norra. It should be noted that all the Scandinavian regions were below the average in terms of income generated by the dairy farms from regions of the European Union with a predominance of intensive milk production.

As in the case of the first factor, the highest factor values are achieved by farms from the regions with better natural conditions for milk production. Lower positions are occupied by regions of mountainous areas or unfavorable for milk production. In the case of farms situated in mountainous areas, the relatively small scale of production is partly compensated by the production of specific products - traditional, high-quality, enjoying the great interest in the local markets and among tourists. Production in the Scandinavian countries due to the harsh climatic conditions, lack of the possibility of grazing and the consequent necessity of obtaining feed is one of the most

expensive throughout the whole European Union. Therefore, their profitability on the single European market is lower than the average. Below the average for a set of regions in the European Union with a predominance of intensive milk production in 2011 in terms of income of dairy farms there were German, Belgian and French regions, as well as Denmark and Estonia. It should be noted that as many as forty-two out of the sixty regions tested were below average, which may suggest a strong deviating from the rest lead of several regions characterized by a significantly higher income than the other.

4. Conclusions

In connection with the previously conducted studies on the increase in the diversity of dairy farms in the macro-regions of the European Union in 2011 in comparison to the state in 2004, it was stated that there might occur a clear separation between the intensive, high concentrated production and extensive with predominance of grazing breeding. Among the cluster with a predominance of intensive milk production concentrated in large farms and very large – i.e. "milk factories" prevailed relatively prosperous regions of EU-15 countries, while among groups of predominantly extensive production of milk definitely regions of the EU-12 dominated, which may confirm the thesis of existing polarization of European milk production. Production of dairy farms in regions with a predominance of intensive milk production was conditioned mainly by price-cost relationships, further non production related costs of running dairy farms and in the least of distinguished factors, income of listed entities. The price and cost relationships in dairy farms from the regions with a predominance of intensive milk production in 2011 were conditioned mostly by total liabilities, of which to more extent by long-term liabilities, and the share of feed for grazing livestock in direct costs as well as interest, which may mean that the farms from the regions with a predominance of intensive milk production carry a lot of investment to modernize and improve its production, seeing in it a chance for further development. The biggest impact on not directly related to milk production costs of running dairy farms in the macro-regions with a predominance of intensive milk production exert short-term liabilities and "decoupled" payments, as well as keeping other cattle except dairy cows and proceeds from the sale of beef and veal and other direct inputs. The income of dairy farms in the macro-regions with a predominance of intensive milk production were mainly conditioned by farm net income, understood as a fee for the involvement of their own factors

of production to the operations of farm and the fee for the risk taken by farmer in financial year, as well as by cash flow I and net worth. In addition, it was noted that less favorable price-cost relationships among farms in regions with a predominance of intensive production occurred in the countries of southern Europe, characterized by a lack of natural pastures and relatively more difficult natural conditions for milk production. The relatively favorable price-cost relationships characterized regions located in the so-called. green belt of the milk production containing the English regions, northern and central regions of the France and German regions (among the regions with a predominance of intensive milk production). Similar dependences relate to income of listed entities. Opposite dependences refer to the second factor - not directly related to the production costs of running milk farms. The highest factors values were recorded in the regions with a predominance of alcove breeding due to the lack of natural grassland with relatively high cost of the external services, which further aggravate the viability relationship.

Summary

Determinants of milk production in FADN dairy farms in the regions of the European Union with predominance of intensive production in 2011

The main aim of the considerations was to determine the factors determining the variability of milk production in selected macro-regions of the European Union. The regions were selected on the basis of the analysis of the diversity of dairy farms FADN in the regions of the European Union, which was determined by the agglomeration cluster analysis using Ward method. In order to highlight the determinants of production there was factor analysis made. On the basis of the results of factor analysis there were factors that have a decisive impact on milk production in dairy farms from areas with a predominance of intensive production identified, and there was a possibility to find out which macro-regions of the European Union reached a relatively best and worst performance in terms of the distinguished factors.

Keywords: *milk production, EU regions, cluster analysis, factor analysis, production determinants.*

Streszczenie

Determinanty produkcji mleka w gospodarstwach mlecznych FADN w regionach Unii Europejskiej z przewagą intensywnej produkcji w 2011 roku

Celem głównym rozważań było określenie czynników warunkujących zmienność produkcji mleka w wybranych makroregionach Unii Europejskiej. Wyboru regionów dokonano na podstawie analizy zróżnicowania gospodarstw mlecznych FADN w regionach Unii Europejskiej, które określono za pomocą aglomeracyjnej analizy skupień metodą Warda. W celu wyróżnienia determinant produkcji dokonano analizy czynnikowej. Na podstawie jej wyników zidentyfikowano czynniki, które miały decydujący wpływ na produkcję mleka w gospodarstwach mlecznych z regionów z przewagą intensywnej produkcji, oraz które z wybranych makroregionów Unii Europejskiej osiągały względnie najlepsze i najgorsze wyniki względem wyróżnionych czynników.

Słowa kluczowe: *produkcja mleka, regiony Unii Europejskiej, analiza skupień, analiza czynnikowa, determinanty produkcji*.

References

1. Guth M. (2015), *Diversity of FADN milk farms in milk farms in the regions of the European Union in 2011*, Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu AR w Poznaniu (Roczniki Naukowe SERiA), XVII (3), pp. 119-124.
2. Grontkowska A. (2012), *Zmiany w wynikach produkcyjnych i ekonomicznych gospodarstw mlecznych najsilniejszych ekonomicznie w latach 2004-2009 w krajach Unii Europejskiej*, Roczniki Nauk Rolniczych, Seria G, Vol. 99, Iss. 1, pp. 58–69.
3. Matuszczak A. (2012), *Podobieństwa i różnice w rozwoju regionów rolnych UE-25 – próba określenia czynników prowzrostowych*, [in:] Pająk, K., Różanski, T. (eds.), *Determinanty rozwoju regionów w Europie; Społeczeństwo, gospodarka, turystyka*, Poli Druk Poznań, Piła 2012, pp. 156–174.
4. Parzonko A. (2006), *Możliwości rozwojowe gospodarstw ukierunkowanych na produkcję mleka,* w: Roczniki Nauk Rolniczych, Seria G Ekonomika Rolnictwa, Vol. 93, Iss. 1, pp. 83–91.
5. Poczta W., Sadowski A., Średzińska J. (2008), *Rola gospodarstw wielkotowarowych w rolnictwie Unii Europejskiej*, Roczniki Nauk Rolniczych. Seria G, Vol. 95, Iss. 1.

6. Ziętara W. (2003), *Efektywność produkcji mleka w wybranych gospodarstwach mlecznych w Polsce i w Unii Europejskiej*, Przegląd Hodowlany No. 2, pp. 4–8.
7. Ziętara W. (2006), *Ekonomiczne i organizacyjne aspekty produkcji mleka przy wysokiej wydajności krów*, Przegląd Hodowlany No. 12, pp. 1–4.
8. Ziętara W. (2010), *Koszty i dochodowość produkcji mleka w polskich gospodarstwach w latach 2006-2008*, Roczniki Nauk Rolniczych, Seria G Ekonomika Rolnictwa Vol. 97, Iss. 1, pp. 53–66.
9. Świtłyk M., Ziętara W. (2008), *Analiza efektywności produkcji mleka i żywca wołowego – Raport 2008*, Wyd. Akademii Rolniczej w Szczecinie, Szczecin.
10. Świtłyk M., ZiętaraW. (eds.) (2012), *Analiza efektywności produkcji mleka i żywca wołowego. Raport 2012*, Wydawnictwo SGGW, Warszawa.
11. Sass R. (2007), *Wielkość stada a dochód z zarządzania w gospodarstwach wyspecjalizowanych w chowie bydła mlecznego*, Roczniki Nauk Rolniczych, Seria G, Vol. 93, Iss. 2, Warszawa, pp. 71-79.
12. Seremak-Bulge J. (2011), *Rynek mleka na progu 2011r.*, Polska Izba Mleka, Białystok.
13. Wójcik A. (2010), *Koszty i dochodowość produkcji mleka w gospodarstwach krajów europejskich*, Roczniki Nauk Rolniczych, Seria G, Vol. 97, Iss. 1, pp. 67–73.
14. Wójcik A. (2012), *Koszty i dochodowość produkcji mleka w europejskich gospodarstwach utrzymujących do 50 krów*, Roczniki Nauk Rolniczych, Seria G, Vol. 99, Iss. 1, pp. 100–107.