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Statistical analysis of factors influencing the results of enterprises in dairy industry

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Abstract: The article deals with companies processing and producing dairy products and cheeses in the Czech market. The dairy industry is a crucial field among the production of food products. On March 31, 2015 the milk quotas were cancelled. The impacts of their cancelation can bring danger for the dairy business but also provide some opportunities. Therefore it is important that businesses are economically powerful and so are able to strengthen their competitive position. This article aims to analyse businesses to identify vulnerable groups of businesses and those groups whose welfare is not essentially jeopardized. Partially, the aim is to assess whether there are significant differences in economic indicators among enterprises of the dairy industry (divided according to their size, ownership and subsidy drawing). At the same time the aim is to find groups of dairy businesses from the set which are similar to each other and which differ from other groups of companies and thus set their position in the Czech market. Over all there were 35 dairy milk businesses analysed in 2013. There were statistically significant differences in some economic indicators among corporations considering drawing grants, size, ownership structure and binding to primary production. According to the cluster analysis the large companies with foreign ownership can be considered as a potential threat and may affect the position and competitiveness of other businesses. The results indicate the endangered position of Czech medium-sized businesses as well as opportunities for stabilizing small businesses which specialize closely.

Keywords: cluster analysis, economic indicators, milk industry, ownership, subsidies

According to Wijnands et al. (2007) and Tacken et al. (2009) the dairy industry holds a very important role in the food industry in the EU. According to available data from Eurostat (to 2012) the EU dairy industry represents 4% from the whole food industry, it employs 8% of workers, it contributes by 10% to a creation of value added and by 13% to turnover. With these characteristics it is located at the fourth, respectively fifth place in terms of food industry sector importance. Labour productivity is 53 thousand EUR per person and is the sixth highest in the food industries. According to the publication Food and Drink Europe (2015) the dairy industry ranks among the most innovative sectors of the food industry. In 2014, the

dairy businesses participated by 6.9% in innovation of food industry, which takes them to second place in the sector. Likewise, Špička et al. (2015) confirms in Czech literature that the dairy companies are among the major recipients of investment grants.

Manufacture of dairy products in the Czech Republic (CZ-NACE 10.5) is one of the key sectors within the food industry. It contributed to revenues from own products and services by 14% according to the latest available data from 2013 (it is the third most important share). The number of companies in analysed field has declined since 2010 to the final number of 156 enterprises in 2013, which represents 2% of the food industry enterprises in the Czech Republic. This

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year there were 8546 persons working in this field (it is 8% of employees from the food industry). It is the fourth largest employer (MoA 2014). According to the publication Food and Drink Europe (2015) dairy products in our country occupy third place in the established food production (after drinks and meat products).

The literature in the field of food industry, where the dairy businesses belong, focuses on both the evaluation of the food industry as a complex and partial areas, respectively dairy industry. In the following text there are selected results of already undertaken researches in the food and dairy industry. Putičová and Mezera (2008) analysed the evolution of the food industry and trends of economic indicators compared to the entire manufacturing industry. The authors stated that the entire manufacturing industry is developing dynamically. However, the importance of food industry decreases with time. In some sectors differentiated and fluctuating trends are seen (in number of employees, sales, value added), but labour productivity grew for the period 2000–2006. Mejstříková et al. (2011) analysed further the positives and negatives of economic performance of food businesses. The authors evaluated the evolution of the milk field and production of dairy products. In 2008 there was a reduction of profitability (ROE) to 2.99% and in 2009 the liquidity decreased. The proportion of equity capital to total assets had increased during the analysed years to 41.62% in 2009. Špička (2013) evaluates the competitive environment of milk processors in the Czech Republic. The financial analysis was used to analyse the economic situation. Porter's five forces model was used for the evaluation of the competitive environment, he evaluated the technical efficiency of milk processors. Economic deterioration was caused by unfavourable prices of inputs and production. The weaknesses of the Czech dairy industry are unbalanced market relations on the input side, but also on production sales side. Researches in the field of dairy industry focus not only on the economy but also point out to the issue of subsidies. Špička et al. (2015) for example dealt with comparing and identifying the differences among innovations in the Czech dairy industry. According to the authors, the dairy industry has been one of the most significant recipients of public support for innovation from the Rural Development Programme (RDP). According to the authors the supports help dairy industry to stabilize their profits and increase their competitiveness during the economic crisis.

MATERIAL AND METHODS

Source data

The first step for the analysis was to create a database of dairy businesses. Primary accounting data from balance sheet (total assets and liabilities) and the income statement (revenues, added value, EBIT and production consumption) and annual reports (information on the number of employees) were used. This data was obtained from the database of companies and institutions Albertina managed by Bisnode. The companies were selected according to the classification of economic activities of CZ-NACE, specifically enterprises whose principal activity is NACE 10.51 processing dairies and cheese making. Information about property relations (Czech or foreign ownership, respectively binding to agricultural production) were obtained from the Arachné database also managed by Bisnode Company. Information on drawn subsidies (the amount and financial program) was obtained from the registry of recipients of grants administered by the Ministry of Agriculture. This article also tracks current data, i.e. 2013. The data file consists of businesses that have complete data this year. Their final number is 35 companies. According to the publication Panorama of Food Industry (MoA 2014) the total number of enterprises in the Czech Republic this year is 156 businesses (CZ-NACE 10.5 in total, i.e. including NACE 10.52 Manufacture of ice cream). Thus the paper analyses 22.4% of all dairy businesses in the country.

The variables

The following indicators were first observed in the companies (2013): revenues per enterprise, debt ratio, labour productivity, profit per employee (EBIT) and production consumption per employee. The indicator of revenues was ranked as the representative of created production of the enterprise. Indicators such as earnings per employee and labour productivity were ranked as an indicator of business performance. The EBIT (which in the Czech Republic corresponds to the operating profit) was used to determine the rate of profit per employee (Grünwald and Holečková 2010). Růčková (2010) considers the operating profit or loss as the most important since it is based on the main activity of the entity. Labour productivity is a key factor of the economic level of the company. It

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is defined as the value of output per unit of labour input. Data on labour productivity characterize the efficiency of utilization of the employed (Kislingerová et al. 2008). Value added was applied for the calculation of labour productivity, because indicator assembled this way is adjusted from the influence, which could artificially affect labour productivity (Synek et al. 2011). Value added in the Czech profit and loss statement is calculated as the sum of sales margin and production lowered by production consumption. Labour productivity was determined as value added divided by the number of employees. Indicator of overall indebtedness (debt ratio) was used to capture the asset structure in this article. Debt ratio reflects the use of foreign resources to finance its own assets. However, debt itself does not mean only negative phenomenon. The increase of indebtedness and its certain amount is helpful because it contributes to the overall profitability and thus to the higher market value of the company (Kovanicová and Kovanic 1995). The high value of the indicator of creditor's risk (debt ratio) may be beneficial from the common shares holders view if the enterprise is able to achieve a higher percentage of return than the percentage of interest paid from borrowed capital (Růčková 2010). An indicator of creditor's risk indicates the degree of coverage of business assets by liabilities and characterizes the financial level of the business. Landa (2008) evaluated positively the outcome of indicators up to 50%, the use of funds to cover more than 50% out of the total capital is seen as a negative. However, Růčková (2010) indicates that it is not possible to define the criteria for optimality, it is important who judges the debt indicator and field in which the company operates. According to MIT (2014), the average debt ratio of enterprises manufacturing food products is 42.8% for the year 2014. Production consumption as a main expense in the operational area of the company has been chosen to represent expense items. Production consumption includes the cost of materials, energy, repairs and maintenance, travel expenses, entertainment expenses, rent and costs for the acquisition of small intangible assets. In the income statement there are these items located among material and energy consumption and services (Knápková and Pavelková 2010). Production consumption is the most important cost item (Růčková 2010). We assume that the effect of the above factors (subsidies, size, ownership and relations to primary production) should occur in these basic economic indicators reported by businesses.

Later on the businesses were categorized according to selected factors that could affect the economy of these enterprises: drawdown of subsidies, company size, origin of the owner and binding to primary production. The effect of subsidies on the economic results of companies was analysed because its impact has been proved on the economy of farming businesses (for example Kroupová and Malý 2010; Brožová and Vaněk 2013; Rizov et al. 2013).

Since the dairy industry is closely related to agriculture, this factor is included to verify whether the enterprises of the dairy industry are different in the above economic indicators among those receiving or not receiving subsidies. Businesses are divided into two categories – companies receiving subsidies and businesses without subsidies. If the value of the economic indicators of businesses receiving subsidies is statistically significant and also better, the authors consider the effect of subsidies as a factor positively influencing the economy of business but also competitiveness. The reason for the inclusion of additional factor – size of business – is that the size of enterprises may be closely related to its performance, which is for example discussed by the authors Gorton and Davidova (2004); Latruffe and Davidova (2007) and Bondareva (2014). Based on these studies the shortage of funds for small businesses and their lower economic efficiency and also a positive relationship between company size and profit can be expected. The businesses were divided into three groups according the size: small, medium and large. The priority criterion for determining the size of enterprises was the number of employees. Businesses with 0–49 employees were categorized as small businesses, businesses with between 50 and 249 persons as middle sized and enterprises employing 250 people or more as large. The origin of the owner of the company was included since foreign-owned companies may be a potential threat to Czech businesses and there is a need to know whether their performance differs from purely Czech firms and whether they can influence, respectively threaten the competitiveness of Czech companies. If it is proved that the values of economic indicators are in the case of foreign companies better and more important, they can be considered as competitors in a better negotiating position due to the current market situation (the abolition of quotas) in the future. Foreign-owned enterprise is an enterprise with more than 50% foreign capital. Factor of binding to primary production (farm) was selected because thanks to this integration dairy businesses may have

better negotiating conditions on raw milk prices than companies with no ties to the farms, which can have a positive effect on the economy. Given that, according to Donnellan et al. (2015) fluctuations in farm prices for milk can be expected as a result of the elimination of quotas, this binding to primary production could assist in stabilizing the situation in the dairy sector, on condition that significant difference in economic indicators is confirmed and of course on condition the values of these indicators are higher than those companies without ties.

Statistical analysis

First, the basic descriptive characteristics (i.e. average, standard error and confidence interval for the average) of quantitative variables (revenues, debt ratio, labour productivity, profit per employee and production consumption per employee) were calculated according to Myers et al. (2010). The data set was tested with Dixon's Q test in order to identify outliers, which were replaced by the value derived from the average of the monitored character, as Miller stated (1993). Further the significance of the impact factor (qualitative variables, i.e. companies with subsidies and without subsidies, foreign-owned companies with Czech companies, small, medium and large businesses, companies linked to primary production and without it) on economic indicator (quantitative variable) was tested by one-way ANOVA analysis (Mayers et al. 2010). Individual results of *F*-test and *p*-value are included in Tables 1–4. If the *p*-value is less than the selected significance level ($\alpha = 0.05$), the null hypothesis about conformity of averages for each factor of selected characters is rejected. This means that the factor is alpha important for chosen significance level.

Cluster analysis is used to figure out how some categories behave and that some do (not) show a similar behaviour, it corresponds to the appropriate inclusion into clusters (Aghabozorgi et al. 2015). The hierarchical cluster analysis was used to create clusters (Gomez et al. 2015), which results in the creation of a hierarchy of groups of objects while polythetic approach was used, i.e. when all the variables were taken simultaneously. According to another sorting criterion methods of agglomerative hierarchical clustering were used (Sautot et al. 2015). This means that the first cluster is formed of two objects on the basis of a matrix of (dis)similarity. In further steps

the (dis)similarity of clusters is determined by using various agglomerative algorithms, in the case of dairy companies in the Czech Republic Ward's method was used based on ANOVA (analysis of variance) (Myers et al. 2010) and combining those clusters where the sum of squares is minimum. Euclidean distance was selected for presenting objects in space, for which the coordinates represent individual variables. Euclidean distance was described in a review study e.g. by the authors Aghabozorgi et al. (2015).

Statistical analysis was performed using Statistica 12 from StatSoft and SPSS. The individual outputs are included in chapter Results and Discussion.

In April 2015, there was the abolition of milk quotas. Impacts of their abolition can bring threats for enterprises but also provide opportunities. Therefore it is important that businesses are economically powerful and so were able to strengthen its competitive position. This article aims to examine whether there are statistically significant differences in economic indicators between enterprises of the dairy industry (divided according to their size, ownership and draw-down of grants). Expected effects of these factors are listed in the above methodology. Another aim of the article is using cluster analysis to find the groups of dairy companies in the set of companies which exhibit similar behaviour on the market and differs from other businesses. By combining the results of these two goals the potential risks and opportunities for arising enterprise groups influencing their future development and competitiveness may be identified. The results will help to determine the current position of dairy companies in the Czech market and to identify those groups of companies (according to the above factors), whose performance is demonstrably better and therefore can be expected to fix their competitive position or growth opportunities within the context of the elimination of quotas.

RESULTS AND DISCUSSION

The set included a total of 35 enterprises of the dairy industry. According to selected considerations stated in the methodology there are 27 companies that receive subsidies (77%) and 8 companies without subsidies (23%). According to the size breakdown, the database is made up of 9 small businesses (26%), 20 medium (57%) and 6 large companies (17%). 26 companies (74%) are owned by Czech entities and 9 (26%) is owned by foreign entities. These are mainly

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the owners from France and Germany. The aspects of ownership linked to the agricultural industry were also noted. 24 dairy firms (69%) included in the set are not linked to primary production and 11 companies (31%) are connected by ownership.

Testing the differences between dairy companies based on selected criteria

This part of the article refers to testing whether there were statistically significant differences between different categories of businesses (according to drawing subsidies, their size, ownership relations and binding to agricultural production) and between the reported financial results of these businesses. *F* test was selected to analyse the statistically significant differences, which determines whether the 4 selected economic characteristics of a quantitative nature (revenues, debt ratio, labour productivity, EBIT per employee and the production consumption per employee) effect the value of five selected variables (mentioned above).

The first test was an indicator of the size of the company, respectively its influence on the economic results of enterprises (Table 1, all values are in thousand CZK, besides debt ratio (in %), *N* means number of observations). 9 out of the 35 companies are small, 20 are medium, and 6 are among large enterprises.

The results show that there are statistically significant differences among companies when classified according to their size. These differences are at a significance level of 5% significance for all financial indicators. Large enterprises have dominant position within the analysed companies of the dairy industry. They contribute 48% in total revenues despite their small number. Due to their size, they are also able to achieve economies of scale, such as those seen in the consumption of materials and energy per employee, which is lower than in medium-sized enterprises. Higher labour productivity in large companies shows a higher degree of utilization of machinery to which the smaller businesses may not have easy access. Small businesses with its production profile and different strategies focus more on the quality of their products. Therefore, there is the lowest apparent labour productivity for small businesses. The significance of large companies in the dairy industry has also been studied by Bourlakis et al. (2014) who also indicates the critical role of large enterprises and considers them as the driving force. As a reasons he states that the big dairy processors are more flexible and according the authors have an impact on the whole integral due to their size and the possibility to buy a significant amount of milk and therefore may have access to better quality. The same applies to the Czech market. Dairies bought 2 319 502 thousands of litres of milk (does not include milk purchased from abroad)

Table 1. Testing of statistically significant differences – company size

Variable	Size	<i>N</i>	Average	Standard error	–95%	95%	<i>p</i> -value
Revenues	small	9	111 453.25	350 920.34	–603 348.08	826 254.58	0.000000
	medium	20	907 020.95	235 404.52	427 517.64	1 386 524.26	
	large	6	2 983 525.00	429 787.88	2 108 075.73	3 858 974.27	
Debt ratio	small	9	71.84	7.74	56.08	87.60	0.000000
	medium	20	58.86	5.19	48.29	69.43	
	large	6	54.67	9.48	35.37	73.98	
Labour productivity	small	9	556.08	243.29	60.51	1 051.66	0.000052
	medium	20	662.17	163.21	329.73	994.61	
	large	6	731.97	297.97	125.02	1 338.92	
EBIT per employee	small	9	89.95	99.66	–113.05	292.94	0.020942
	medium	20	126.53	66.85	–9.65	262.70	
	large	6	199.27	122.06	–49.35	447.90	
Production consumption per employee	small	9	3 229.13	1 534.53	103.39	6 354.86	0.000036
	medium	20	4 832.47	1 029.39	2 735.66	6 929.28	
	large	6	4 577.87	1 879.41	749.64	8 406.09	

All values are in thousand CZK, besides debt ratio (in %), *N* means number of observations

Source: own processing

in the Czech Republic in 2013 (CZSO 2015). One of the largest processors out of these – Madeta a.s., buys 0.4 billion litres of milk annually (Madeta 2013), representing 17.25%. Olma a.s. purchased 192 million litres of milk in 2013 (Olma 2014). The three largest analysed companies operating in the Czech market contributed to total sales almost by one third.

The other examined variable were subsidies (Table 2), respectively whether there are statistically significant differences between the financial results of companies that are receiving and not receiving subsidies. 27 companies out of the total of 35 companies receive grants. According to achieved *p*-values at a significance level of 5%, it can be said that there were statistically significant differences in selected economic indicators (except EBIT per employee) between the economic results of the businesses receiving subsidies and businesses that do not receive subsidies. Businesses that receive subsidies have on average higher revenues than firms without subsidies, as well as have higher labour productivity and higher EBIT per employee. Better labour productivity of these enterprises can be expected through the use of modern machinery and techniques acquired within subsidies that have an investment nature. Production consumption per employee is lower in companies benefiting from subsidies. Businesses have the opportunity to draw resources both from the Czech Republic, according to the Principles of the Ministry of Agriculture (Grant program 13 Supporting the processing of agricultural products and increasing the competitiveness of the food industry) and the Rural Development Programme 2007–2013 (Axis I Adding value to agricultural and food products). Newly also

the RDP 2014–2020 under the measures Investments In Tangible Assets (Processing and marketing of agricultural products) and the Cooperation (Support for the development of new products, processes and technologies for agricultural products processing and marketing).

It follows that the economic indicators of dairy enterprises receiving subsidies, which have mainly investment character, differ significantly from the companies that do not receive the grants. Values of indicators are also more favourable for the enterprises with subsidies. Therefore a positive impact of subsidies on the economy can be assessed. In the future, it is important to continue with supporting this sector because it helps businesses to achieve better results and be more competitive. Špička et al. (2015) also dealt with similar topic. According to them the supports help dairies to stabilize profits, increase their competitiveness and generally include dairy industry among one of the most significant recipients of public assistance from the RDP. Likewise Klerkx and Nettle (2013), according to whom the institutional support in the dairy industry in innovation and production processes is important so that individual actors are able to operate more efficiently. According to Doluschitz (2009), political support after the abolition of quotas will be crucial for the structural adaptation to the new conditions. It is important to focus on competitiveness and investment promotion.

Majority of analysed dairy enterprises is owned by Czech entities (74%). According to the *F*-test selected indicators of enterprises owned by Czech entities are significantly different from foreign-owned enterprises (Table 3). These are significant differences in all five

Table 2. Testing of statistically significant differences – subsidies

Variable	Subsidies	<i>N</i>	Average	Standard error	–95%	95%	<i>p</i> -value
Revenues	no	8	998 151.00	50 0732.19	–20 596.30	2 016 898.30	0.000926
	yes	27	1 076 275.56	272 564.08	521 739.77	1 630 811.36	
Debt ratio	no	8	72.11	8.13	55.57	88.65	0.000000
	yes	27	58.33	4.43	49.33	67.33	
Labour productivity	no	8	622.43	254.98	103.68	1 141.19	0.000108
	yes	27	654.09	138.79	371.72	936.46	
EBIT per employee	no	8	50.87	103.71	–160.13	261.87	0.093730
	yes	27	152.92	56.45	38.06	267.77	
Production consumption per employee	no	8	4 544.03	1 621.51	1 245.04	7 843.02	0.000033
	yes	27	4 326.91	882.64	2531.16	6 122.65	

All values are in thousand CZK, besides debt ratio (in %), *N* means number of observations

Source: own processing

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Table 3. Testing of statistically significant differences – ownership structure

Variable	Ownership (CR)	N	Average	Standard error	–95%	95%	p-value
Revenues	no	10	2 201 506.60	381 138.65	1 426 074.18	2 976 939.02	0.000001
	yes	25	601 183.29	241 053.25	110 756.77	1 091 609.81	
Debt ratio	no	10	57.33	7.46	42.15	72.51	0.000000
	yes	25	63.14	4.72	53.54	72.74	
Labour productivity	no	10	792.43	226.12	332.38	1 252.47	0.000011
	yes	25	588.63	143.01	297.67	879.58	
EBIT per employee	no	10	142.29	93.77	–48.49	333.07	0.021955
	yes	25	124.51	59.31	31 472,00	245.17	
Production consumption per employee	no	10	5 116.99	1 442.59	2 182.02	8 051.96	0.000006
	yes	25	4 080.35	912.37	2 224.12	5 936.59	

All values are in thousand CZK, besides debt ratio (in %), *N* means number of observations

Source: own processing

analysed financial indicators. Foreign-owned companies operating on the Czech market are mostly owned by the French and German operators. The average values of businesses owned by a foreign entity achieve higher values for all the variables than the average values of the companies owned by Czech entities. Debt ratio of these enterprises is also lower. Given that the successful large enterprises are mostly foreign owned we can also expect endangering the position of Czech dairy companies due to the abolition of milk quotas. These dairies are likely to exercise their production on the Czech market and the competitiveness of Czech processors may be endangered. At the same time according to Dries and Swinnen (2004), foreign investors may negatively affect the local small suppliers

because they cannot meet the stricter standards or to reduce transaction costs. On the other hand, foreign companies can implement programs to help farmers overcome the shortcomings of the market through horizontal and vertical effects resulting in improved access to financing, increase of investment, improve product quality and growth of small suppliers. Foreign investments can bring new products, technologies and domestic companies can benefit. The fact that foreign businesses are a major player on the Czech market was confirmed by the Ministry of Agriculture (2013). Situation and Outlook Report Milk in 2013 states that the total share of processed milk in dairies of foreign investors was 40% in 2012. In the case of Germany, this share is 12% (Friedrich 2010). The

Table 4. Testing of statistically significant differences – binding to agricultural production

Variable	Binding to agricultural production	N	Average	Standard error	–95%	95%	p-value
Revenues	no	24	1 059 808.51	289 179.79	471 467.81	1 648 149.21	0.000253
	yes	11	1 055 385.82	427 146.85	186 349.01	1 924 422.62	
Debt ratio	no	24	63.39	4.81	53.6	73.18	0.000000
	yes	11	57.30	7.11	42.84	71.76	
Labour productivity	no	24	691.64	146.58	393.42	989.86	0.000039
	yes	11	549.14	216.51	108.64	989.63	
EBIT per employee	no	24	117.45	60.43	–5.51	240.40	0.016073
	yes	11	156.09	89.27	–25.52	337.71	
Production consumption per employee	no	24	4 845.20	925.00	2 963.27	6 727.12	0.000020
	yes	11	3 354.00	1 366.31	574.21	6 133.79	

All values are in thousand CZK, besides debt ratio (in %), *N* means number of observations

Source: own processing

three largest foreign companies are involved in 36% of total sales in the group of analysed companies.

The last analysed indicator was binding to primary agricultural production (Table 4). 69% of the analysed companies do not have this link with primary production. There were demonstrated statistically significant differences between companies with this binding and without it also in all 5 quantitative financial indicators. Enterprises with this binding show slightly lower revenues, labour productivity and production consumption. On the contrary, they are less leveraged and have higher EBIT per employee.

Binding to agricultural production, respectively cooperation has been solved in the dairy industry also by Soboh et al. (2014) who compared the effectiveness of cooperation with investor companies producing milk and milk products. The results show that cooperation in the dairy industry is using more productive technologies, but they are less effective than firms owned by investors. Lower efficiency was partially confirmed in this article. Businesses linked to primary production generate on average lower sales and lower labour productivity.

Cluster analysis

The aim of the next section was to determine whether there are companies in the dairy industry that exhibit similar behaviour. Enterprises have been classified into four clusters. The first cluster includes 19 companies, another cluster includes 9 companies, the third cluster 6 companies and the last cluster consists of only one company. The Figure 1 captures the division into individual clusters. The vertical line shows the individual businesses that were numbered (1 to 35).

The cluster 1 was grouping 19 companies (Table 5). It is the largest cluster in terms of the number of listed firms. There are 74% of medium-sized businesses of all enterprises of this size and it is mostly made up of limited liability companies (LLC), 58% of all the analysed companies have this legal form. Businesses in this cluster have average revenue of 463.1 million CZK, labour productivity 635.3 thousand CZK, power consumption per employee in the amount of 4.4 million CZK, EBIT per employee 130.4 thousand CZK and 61% debt. These are mainly businesses that receive subsidies, are medium in size and owned by Czech entities. This category of enterprises may be threatened due to the current market situation. It shows average economic outcomes (the SMEs)

which are owned by Czech entities (this category is significantly different, respectively has lower results than foreign companies).

Cluster 2 includes 9 companies (Table 5). 78% of businesses in this cluster do not receive subsidies and are made up of 44% of small businesses (of the total number of analysed small businesses). There are only 25% of medium-sized enterprises in the total number of analysed businesses of this size, 89% of companies with no connection to primary production. 6 companies in this group have the legal form of a limited liability company, representing 33% of all analysed businesses of the legal form. There are 50% of enterprises out of the total number of businesses owned by foreign entities in this cluster. The achieved average values of financial indicators are lower than in cluster 1 (excluding the average turnover of the enterprises) which confirms that this cluster brings together small size businesses. The average values of enterprises in cluster 2 reached the following: revenues CZK 533.2 mil., debt 68%, labour productivity 300.5 thousand CZK,

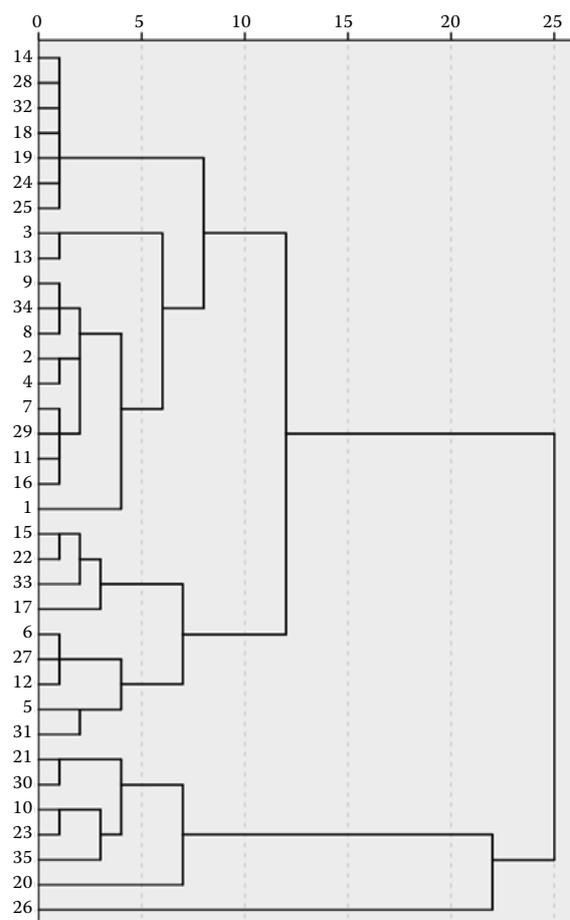


Figure 1. Cluster analysis

Source: own processing

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Table 5. Cluster 1

Variable	<i>N</i>	Average	Median	Min	Max	Standard error
Revenues	19	463 128.32	444 797.00	22 640.00	1 357 758.00	330 716.31
Debt ratio	19	61.34	59.12	28.25	100.36	20.50
Labour productivity	19	635.32	460.99	107.37	2 524.06	603.99
EBIT per employee	19	130.39	66.57	–386.28	952.65	287.92
Production consumption per employee	19	4 415.49	3 551.52	315.53	17 699.64	3 830.92

All values are in thousand CZK, besides debt ratio (in %), *N* means number of observations

Source: own processing

on average 14 thousand CZK EBIT per employee. The average production consumption per employee is 2.2 mil CZK. Dairy companies that do not receive subsidies have common characteristics, they are smaller in size and without ownership binding to the primary agricultural industry.

More than half of the companies classified in this cluster specialize only in the production of cheese and other dairy products are not produced. Despite the fact that these are small businesses which generally have lower economic results, they are mainly owned by foreign enterprises that can help them to strengthen their position in the market (due to the fact that foreign companies show better results than Czech businesses).

Table 7 shows the basic characteristics of the third cluster. The third cluster consists entirely of large enterprises (6), all companies receive subsidies and 83% of them operate as a limited company in the market. There are 67% of businesses owned by a foreign entity in cluster 3. The achieved average values of financial indicators are reasonably high. Average revenue amounted nearly 3 billion CZK, the variation range for this indicator is the broadest of all 4 clusters. Businesses in this cluster are characterized by the second lowest debt (55%). These businesses have high labour productivity 732 thou-

sand CZK and every employee brings 200 thousand CZK of operating profit (EBIT) to the company. The average value of power consumption per employee is 4.6 million CZK. Corporations included in this cluster generally have higher, respectively better (relating to debt) average values over the previous two analysed clusters. The sensitivity of corporate binding to the primary production was not showed in this cluster. There are most dairies owned by German capital and farmers and other private investors in Germany. Foreign ownership is not so common. For comparison, there are currently 3 big foreign investors (Friedrich 2010).

This cluster represents a potential threat for companies from the other clusters. Their position is very strong whereas the cluster is formed by large businesses whose economic results are better and at the same time differ significantly from the other size categories (see previous analysis). Four out of the six businesses in this cluster are foreign-owned. Foreign companies generally have better results and so they can endanger other groups of companies. In the context of the abolition of quotas it could lead to a weakening the position of Czech producers.

Cluster 4 includes one company that does business as a limited company and is owned by a foreign entity. This company is not linked to primary production

Table 6. Cluster 2

Variable	<i>N</i>	Average	Median	Min	Max	Standard error
Revenues	9	533 213.00	282 469.00	856.00	2 063 659.00	692 985.28
Debt ratio	9	67.87	68.31	15.00	122.19	30.80
Labour productivity	9	300.45	257.00	–154.71	733.31	281.88
EBIT per employee	9	13.96	37.50	–381.43	418.17	237.04
Production consumption per employee	9	2 170.51	1 554.94	150.71	5 799.16	1 728.23

All values are in thousand CZK, besides debt ratio (in %), *N* means number of observations

Source: own processing

Table 7. Cluster 3

Variable	<i>N</i>	Average	Median	Min	Max	Standard error
Revenues	6	2 983 525.00	2 633 219.50	1 828 938.00	5 359 715.00	1 182 215.10
Debt ratio	6	54.67	56.85	28.30	70.68	14.45
Labour production	6	731.97	690.30	426.06	1 153.36	261.54
EBIT per employee	6	199.27	84.96	0.73	602.81	225.32
Production consumption per employee	6	4 577.87	4 653.09	1 959.97	7 659.94	2 000.16

All values are in thousand CZK, besides debt ratio (in %), *N* means number of observations

Source: own processing

and by number of employees it is among the medium-sized companies. The company achieves the highest sales (5.5 billion CZK) and is the least indebted (47%), labour productivity is a 3.5 mil. CZK, operating profit (EBIT) per every employee is 2.9 million CZK and power consumption is 22.3 mil. CZK. It can be said that this company has the highest values among all analysed enterprises (the maximum in the total set of dairy enterprises).

Cluster analysis groups the companies with similar behaviour so they were classified into 4 clusters. By this classification the groups of companies with significant market positions were identified. This group consists of large companies with foreign ownership, which could negatively affect the competitiveness of medium sized enterprises with the Czech owner, which is called a group in risk. Potential can be seen in the group of small business specializing in the production of cheese.

CONCLUSION

The analysis of dairy companies operating in the Czech market was conducted. The analysed sample consisted of 35 companies and 77% of them drew subsidies, 26% of businesses are small businesses, 57% are medium businesses and 17% are large companies (according the number of employees). 74% of companies from the analysed sample are owned by Czech entities and 69% of companies are not linked to primary production. One aim of the article was to examine differences between different categories of businesses, divided according to drawing grants, company size, origin, owner and ownership relation to primary production and to determine the significance of their impact on the 5 selected economic indicators (sales, debt, labour productivity, profit per employee and power consumption employee).

There were statistically significant differences in all economic indicators of enterprises divided by different criteria (factors) at a significance level of 5%. The only exception is EBIT per employee which is an insignificant factor for grants. This part of the analysis shows the importance of aid flowing into the dairy industry and its positive effects on the economy of businesses and also need to direct this aid into small enterprises to strengthen their position and competitiveness.

According to cluster analysis of enterprises of the dairy industry in the Czech Republic it has been found that firms that exhibit similar behaviour which draw subsidy are medium in size and owned by a Czech entity. Differently from them behave businesses that do not draw subsidies and are small in size. Similar characteristics are analysed for all major businesses. Analysed businesses were divided into 4 clusters, the first of them includes 19 companies, the other 9 companies, 6 companies and last third cluster consists of only one company. Article identified the important position of large companies on the Czech market and also foreign-owned enterprises. There are foreign companies included among the “leaders” of the market, which have been analysed and which may due to the elimination of quotas in the market jeopardize the competitiveness of other companies operating in the field. This is essentially a threat to domestic production, represented by a group of medium-sized companies with Czech ownership. However, the group consisting of small businesses that are very narrowly specialized (cheese production) also has the potential. Extending Czech firms may be an opportunity but at the same time it is a challenge to face big international competition as well as the opportunity to apply their products in the global market. Therefore, it will be important to continue with maintenance of the good economic performance of these enterprises.

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