

Influence of Qualitative Factors on Quantitative Determinants in the Czech Meat Industry Economy

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Abstract

The meat industry is one of the key sectors within the food industry in the Czech Republic. Development, especially in the pork production, is unfavourable. Negative foreign trade balance and low self-sufficiency is reported. Czech market products compete with foreign imports of meat and economic performance of enterprises plays an important role in this field. Article aims to identify qualitative factors limiting the competitiveness of the meat industry and to identify groups of enterprises with key position. The size of a company was confirmed as an only factor limiting the competitiveness. Statistically significant differences among the three performance indicators (out of the four analysed) were demonstrated. The larger the enterprise, the greater values of indicators are. Form of company ownership, drawing subsidies and region of the company cannot be confirmed as factors influencing the economic performance and competitiveness.

Keywords

Meat industry, competitiveness, economic performance, cluster analysis, food processing industry, economy of enterprises.

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Introduction

The meat industry belongs to food processing industry, which is one of the most important sectors in the whole EU as well as in Member States with high importance for economic and environmental development but also for social welfare (Bigliardi and Galati, 2013). Food processing industry plays an important role as an employer, but it is also important for its economic outcomes. It is the base for the competitiveness of the agricultural market in each EU country. Its important role arises from the processing of agricultural raw materials and the food supply for population (Menrad, 2004).

Economic research focuses more on the area of the Czech food industry as a complex rather than on its individual processing fields. For example, Putíková and Mežera (2008) dealt with this issue. They analysed the development of the food processing industry and the trends in economic indicators in comparison with the entire manufacturing industry. The authors stated that

the entire manufacturing industry is developing dynamically. However, the importance of the food industry decreases over the time. Differentiated and fluctuating trends are seen in individual production fields (in number of employees, sales, value added), on the other hand the labour productivity grew for the period 2000-2006. According to Mejstříková et al. (2011), the food industry is a major area of the agrarian sector and its financial-economic results affect the development of agriculture and other related subjects. The authors analyzed the positives and negatives of economic performance in food processing business. The results show an intersectoral heterogeneity of profitability. Čechura and Hockmann (2010) also analysed the Czech market. They identified the uneven development of the food processing industry. Results indicate serious problems including problems in the capital market. According to research of Hockmann et al. (2013) the key determinants of competitiveness in the food industry are: changing consumer preferences towards higher quality and nutritionally valuable

foods and the changing purchasing power of the population on one hand; progressive trade liberalization creating new competitive environment accompanied by structural changes in the food industry on the other hand. The meat industry is among the key sectors of the food industry both in the EU and the Czech Republic.

The study Food Drink Europe (2015) summarizes the basic economic performance of the food industry in the EU. The meat industry represents 14% of the food and drink industries of the EU which makes it the second highest number of enterprises after the bakery industry (54% of enterprises). The sector employs 21% of employees in the food industry (the second highest number of people). It contributes by 15% (which is the fourth highest part) to the value added of food industry and has a turnover of 20% (the highest portion). However, labour productivity is very low, it is below average of food and beverage industry, i.e. 33 000 EUR/person (the second lowest labour productivity).

A publication Panorama of Food Industry (MoA, 2015) is dedicated to the problems of the food processing industry in the Czech Republic. According to this publication, the meat industry reached 22.9% of total revenues from the sales of own products and services of food industry in 2014. In this field there is the fourth highest number of companies (i.e. 23.8%), which employ 24.4% of the entire food industry. The food industry contributed with 17.4% to the value added of food processing industry in 2014, i.e. the third highest part. Problematic area of the meat industry is a long-term decline in the number of employees in this field (in 2014 the company employed 21 051 persons); as well as low labour productivity (484 000 CZK) and a low average wage per month of employees. In the long term the lack of competitiveness in the pork production is reported, especially the negative foreign trade balance. Decrease in the number of pigs and sows as well as low self-sufficiency, especially in pig and poultry meat are among the greatest challenges of livestock production in the Czech Republic. The declining self-sufficiency is involved in increasing pork imports that compete with domestic supply and thus influence the profitability of the sector. According to the above stated data the situation of meat processors does not develop very favourably. For this reason, the economic performance of enterprises plays an increasingly important role in this field, and identifies competitive position of those companies on the Czech market.

This article aims to identify qualitative factors limiting the competitiveness of the meat industry enterprises measured by their economic performance. Partial goals are to find statistically significant differences in the selected indicators and in qualitative factors; to perform cluster analysis and to identify groups of companies with similar characteristics on the market. To find a group of companies that can be considered as endangered or their position is crucial and to identify factors affecting their market position will be found as a synthesis of partial goals in this article.

Materials and methods

Data and variables

The primary source for a database of enterprises of the meat industry was a database of companies and institutions Albertina, managed by Bisnode company. This database provides individual data from financial statements (balance sheet and profit and loss statement) of businesses. The selection of companies was carried out according to the CZ-NACE businesses (i.e. the classification of economic activities). This means that companies engaged in the production field 10.1 Processing and preserving of meat and meat products (just as the predominant activity) were selected. A total of 233 enterprises were subject to evaluation in 2014.

Accounting data as added value, production consumption, revenues from sales of own products and services, assets, EBIT and additional indicator of the number of employees (all data for 2014) from the Database Albertina were used for a purpose of this article. Four financial evaluation indicators, respectively economic analysis were set based on this data. The indicators reflect internal and external business environment and can be considered to be the basic representatives of company competitiveness measured by their performance. Evaluation of competitiveness based on financial indicators was done, for example by authors Liargovas and Skandalis (2010), Habib (2006), Meric et al. (2011). This includes the following quantitative indicators:

- Labour Productivity: a representative of business performance that reflects the economic level of enterprise and efficiency of employee utilization (Kislingerová et al., 2008). Labour productivity was determined as the converted value added per employee.
- Revenues: It is an item of profit and loss statement - Revenues from sale

of own products. The indicator was ranked as a representative of a production created by a company.

- Production Consumption: an indicator representing the key cost item of the operating area of the company. It is a unit profit and loss statement- Production consumption, which includes the cost of materials, services and energy.
- Return on assets (ROA) is calculated as the ratio of profit before interest and taxes, and the total amount of assets. As an indicator for measuring competitiveness was ROA used for example by Tangen (2003) and Berman et al. (1999).

Qualitative factors limiting companies' performance

Latruffe (2010) specifies determinants of competitiveness of the agricultural and agri-food sector and divides them into two groups. The first are the determinants controllable by the company, i.e. size and other structural characteristics (legal form, intensity of factor use; indebtedness; specialization of business), social capital (age of the entrepreneurs, education, gender, etc.). Determinants, that are not controllable by the company, i.e. equipped by factors (sources of labour, land and capital) and conditions of demand; government restrictions in the agricultural sector; public expenses for research and infrastructure; location of activities.

Determinants forming the competitiveness of the agri-food sector have been set with respect to the data availability. Meat industry businesses were divided and analysed according to selected qualitative characteristics, i.e. according to their size, form of ownership, using grants and regions. These are the factors that have been identified as factors limiting the competitiveness of meat companies measured by financial and economic indicators.

Businesses were classified into four groups according to the size, i.e. the micro, small, medium and large businesses. The primary criterion for classification was the number of employees. Micro-enterprise is an enterprise which employs 0-9 employees; small enterprise employs 10-49 employees, medium companies are with 50-249 employees, and large enterprise has more than 250 employees. Czech Statistical Office commonly use this criterion. Widely used is also criterion based on the Recommendation 2003/361/ES) which use also turnover and annual

balance sheet. The authors are aware of possible different results when choosing this indicator in point of view to the definition of size of company. Information about the number of employees was obtained from the database of companies and institutions Albertina. In case of missing data for some enterprises, the information was searched at justice.cz in a section of annual reports. Overall 102 micro enterprises, 82 small companies, 34 medium and 15 large enterprises were analysed.

According to the forms of companies' ownership, the meat industry is divided into the following categories: individual ownership (in this category there are firms owned by one person); family ownership (incorporated businesses with owners of the same name); other ownership (company owned by various people) and foreign ownership (enterprises with owners of foreign origin with an ownership greater than 50%). Information about the ownership of individual firms was obtained from the Arachné database, managed by the company Bisnode, which focuses on ownership in companies. Their own classification of property into the above groups was carried out based on the data. A total of 67 individually owned companies, 69 family owned enterprises, 91 enterprises of other ownership and 6 foreign companies were analyzed.

The penultimate qualitative criterion was subsidy drawing. Meat industry businesses are part of the processing industry and therefore they have the opportunity to benefit from the Rural Development Programme support. i.e. 1.3.1 Adding value to agricultural and food products (valid for RDP 2007-2013). Based on this factor, the enterprises have been divided into three groups, i.e. companies which benefited from a subsidy (enterprises that applied for a grant in 2012-2014, were supported and their applications for aid have been paid); businesses that did not draw subsidies (businesses did not apply for the support within that time period) and businesses that applied for a grant, but did not receive it, thus were not supported. Information on drawn subsidies of the meat industry enterprises was obtained from the Registry of grant recipients, managed by the Ministry of Agriculture. In the evaluation there were 40 supported companies, 167 businesses that did not receive subsidies and 26 companies that have failed in obtaining a grant and were not supported.

The last factor which was monitored by meat businesses was a region in which the business is located. Criterion of location (country, region), have been used by for example Bakucs et al. (2010).

Frequencies of enterprises in individual regions will be shown in the tables of basic descriptive characteristics.

Qualitative variables with greater than 75% statistically significant effect on quantitative indicators were evaluated as a factor affecting competitiveness.

Database Albertina provides accounting data for 316 companies in manufacturing sector 10.1 Processing and preserving of meat and meat products in a time period from 2010 to 2015. Data for 2015 are not complete; it is only listed for minimum companies therefore the year 2014 was evaluated. Data was gathered from 233 companies that year. Thus the article analyses 73.7% of companies with available accounting data.

Statistical analysis

At first, the basic descriptive characteristics - some measures of location and variability, such as mean, 95% lower and upper confidence interval of mean, median and standard deviation - were calculated for individual enterprises of Processing and preserving of meat and meat products (CZ-NACE 10.1) industry. Furthermore, the relative and absolute frequencies were evaluated, i.e. frequency tables for various economic indicators based on qualitative factors were made (Brase and Brase, 2016).

Then, statistical differences of the impact of factor (the individual categories of mentioned qualitative variables) per average levels of monitored economic indicators were observed using one-way analysis of variance (one-way ANOVA). The ANOVA is a standard used tool (Rossi and Mirtchev, 2016). The null hypothesis is that the average values of the given economic indicator are the same for all observed groups classified by the given factor. An alternative hypothesis is that at least one of the monitored groups differs with its average from other average values. Analysis of variance is based on the F test. Output of F test is p-value, which is compared with the significance level $\alpha = 0.05$. If $p < \alpha$, then we reject the null hypothesis (Baguley, 2012). Within ANOVA there is sometimes performed so-called multiple comparison using a post-hoc tests (Cardinal and Aitken, 2013) however, it is not covered in the paper.

Furthermore, cluster analysis was used, specifically Hierarchical Cluster Analysis, tracking the similarity of enterprises' behaviour on the basis of monitored economic indicators as authors

(Santis et al., 2016) use it. The paper uses Ward's method as a Cluster Method with chosen measure Squared Euclidean Distance (Rasmussen, 1992). The output of cluster analysis is a graphical representation of clusters using dendrogram (Bennani and Benabdeslem, 2006).

Results and discussion

The results are organized according the examined qualitative factors that have been identified as possible factors affecting competitiveness (defined by selected quantitative indicators) of the meat industry enterprises. Basic descriptive statistics are always listed (mean, 95% lower and upper confidence interval of mean, median, standard deviation), including statistical significance of influence of qualitative variables on financial-economic indicator (p-value).

Size of business

Size of the company was the first examined factor, respectively its impact on the performance indicators shown in Table 1. Average labour productivity is the lowest in micro enterprises, highest in large enterprises. The larger the enterprise, the greater is its average labour productivity. However, the productivity grows more slowly with increasing size (in the case of medium and large enterprises it is very similar). Wide range of values (minimum and maximum) is evident for micro and small enterprises, which is primarily due to the nature of enterprises, i.e. family firms with a small number of employees, which increase the value of this indicator. Testing statistically significant differences in this indicator by size category proved to be significant (p-value).

Average revenues of micro and small enterprises are at closely comparable level. In the case of micro enterprises they are even slightly higher. On the other hand, the difference between revenues of medium and large enterprises is significant (large companies have in average higher revenues by more than 1 mil. CZK). Values of indicators differ significantly across the size categories. In connection with this indicator, a linear development of pivotal cost indicator was proved, i.e. production consumption has shown where its value differ significantly among other companies. However, there is no reduction in the consumption of materials, energy and services as the business grows.

Micro and small enterprises reported a negative ROA in 2014 due to the negative profit. Profitability of medium and large enterprises is low, while large firms reported higher profitability. However,

Economic indicator	Size of business	N	Mean	95% Lower Confidence Interval for Mean	95% Upper Confidence Interval for Mean	Median	Std. Deviation	P-value ANOVA
Labour productivity	Micro	102	165.62	104.66	226.59	0	308.84	0.000029*
	Small	82	286.83	241.46	332.21	247.54	206.51	
	Medium	34	370.03	312.89	427.17	337.75	163.75	
	Large	15	378.62	275.48	481.76	317.02	186.24	
Revenues	Micro	102	65 853.35	-29 368.73	161 075.42	787.00	482 350.69	<0.000001*
	Small	82	62 978.88	43 601.12	82 356.64	30 099.75	88 191.32	
	Medium	34	355 068.12	265 299.36	444 836.88	273 751.00	257 278.64	
	Large	15	1 442 223.07	799 576.48	2 084 869.66	1 495 991.00	1 160 469.50	
Production consumption	Micro	102	56 041.90	-21 547.74	133 631.53	1 635.00	393 032.95	<0.000001*
	Small	82	59 813.47	41 977.43	77 649.51	33 727.75	81 174.71	
	Medium	34	313 091.75	229 436.49	396 747.01	219 945.50	239 757.26	
	Large	15	1 359 331.97	841 204.89	1 877 459.05	1 383 939.00	935 616.38	
ROA	Micro	102	-0.14	-0.36	0.08	0	1.11	0.620629
	Small	82	-0.02	-0.09	0.05	0.02	0.32	
	Medium	34	0.01	-0.03	0.05	0.04	0.12	
	Large	15	0.02	-0.01	0.06	0.03	0.06	

Note: * Statistically significance of influence of company size on economic indicators (testing on level of significance $\alpha=0.05$). All indicators are in thousands CZK, ROA in CZK.

Source: own processing

Table 1: Descriptive statistics and one-way ANOVA for factor „Size of business“, year 2014.

the values of this indicator do not differ significantly in individual size categories of meat enterprises.

The size of the business can be considered as a factor limiting the competitiveness of enterprises of the meat industry. Statistically significant differences among the three performance indicators (out of the four analyzed) were demonstrated. Whereby it was confirmed that larger businesses show a better performance characteristics as confirmed for example by Carroll et al. (2009), Zhu et al. (2008), Latruffe et al. (2004). Therefore it can be agreed with the statement that large firms achieve economies of scale and can benefit from preferential access to the market of inputs and outputs (Hall and LeVein, 1978). On the contrary, an inverse relationship between the size of the business and its productivity was proved by Munroe (2001) or O'Neill and Matthews (2001). According to Buckwell and Davidova (1993) the explanation for this relationship is that small businesses are not affected by the need to control labour or organizational problems and the family workforce is highly motivated to benefit from their own business.

Business ownership

Effect of ownership on the economic results of meat enterprises is documented in Table 2. Individual business or small family firms may be associated with certain traditions and craft activities, so there is an obvious lower labour productivity than in foreign-owned enterprises of the meat industry.

On the other hand, the age of the owner may be the reason for the low productivity. Older owners may not be willing or able to accept the possibility of technological innovation (Lambarraa, 2009). On the other hand, older owners can use their experience and knowledge for more efficient use of inputs (Munroe, 2001; Mathijs et al., 2001). This indicator is not statistically different among the categories of enterprise.

Statistically significant differences were confirmed for the indicators of revenues and production consumption. Family businesses report the lowest revenues; foreign-owned businesses report the highest. The average return on assets was negative for individually owned and other enterprises in 2014. The highest ROA was in family businesses, which is confirmed by the results of Buckwell and Davidova (1993) who claim that family businesses are very motivated to prosper. Indicator is not statistically significantly different according to business ownership. Similar results ie. no effect on the return on assets, respectively return on sales, in the food business are confirmed by Schiefer and Hartmann (2008).

According to the results foreign-owned enterprises may be the best performing group, because they have the highest values of the evaluated indicators. The position of other categories of enterprises is not clear, which was confirmed by the authors Davidova and Gorton (2004), whose results indicate no clear superiority of performance either in family

Economic indicator	Business ownership	N	Mean	95% Lower Confidence Interval for Mean	95% Upper Confidence Interval for Mean	Median	Std. Deviation	P-value ANOVA
Labour productivity	Individual	67	216.42	165.48	267.36	217.33	208.83	0.193638
	Other	91	236.18	192.22	280.14	232.15	209.88	
	Family	69	298.5	214.83	382.17	245.48	348.3	
	Foreign	6	359.29	9.14	709.43	393.35	333.65	
Revenues	Individual	67	127 227.46	44 469.53	209 985.40	8 844.00	339 284.27	0.027145*
	Other	91	285 386.48	124 200.16	446 572.81	43 948.00	769 584.35	
	Family	69	107 057.36	43 224.83	170 889.88	19 208.00	265 718.38	
	Foreign	6	654 189.50	-319 125.31	1 627 504.31	148 915.00	927 464.99	
Production consumption	Individual	67	126 481.99	47 088.15	205 875.84	12 633.00	325 492.45	0.027686*
	Other	91	246 350.36	111 731.71	380 969.01	40 480.00	642 736.97	
	Family	69	105 019.53	43 532.47	166 506.58	18 729.00	255 954.79	
	Foreign	6	617 976.92	-319 890.10	1 555 843.93	111 727.00	893 687.03	
ROA	Individual	67	-0.19	-0.52	0.13	0	1.35	0.353767
	Other	91	-0.05	-0.11	0.01	0.01	0.29	
	Family	69	0.04	-0.02	0.1	0.03	0.25	
	Foreign	6	0.03	-0.06	0.12	0.05	0.09	

Note: * Statistically significance of influence of company size on economic indicators (testing on level of significance $\alpha=0.05$). All indicators are in thousands CZK, ROA in CZK.

Source: own processing

Table 2: Descriptive statistics and one-way ANOVA for factor „Business ownership“, year 2014.

businesses or other types of businesses.

Form of company ownership according to testing the significance of differences cannot be considered as a factor limiting the competitiveness of enterprises of the meat industry.

Subsidies

In Table 3 there is a difference in performance indicators when dividing enterprises according to the use of grant resources. The lowest labour productivity is reported by firms that did not apply for support. Average labour productivity of businesses that have been supported is higher than labour productivity of firms that did not receive support (ie. eventually they had to finance the investment by themselves). However, the labour productivity does not differ significantly which was confirmed by testing statistically significant difference by p-value. The impact of subsidies can be assessed as positive since supported businesses have higher labour productivity. Similarly, it is confirmed in the Czech agri-food by Špička and Krause (2013), Medonos et al. (2012).

Supported businesses also have the highest revenues. However, in case of production consumption they do not achieve economies of scale and value of this indicator is also the highest. Both revenues and the production consumption differ significantly among categories. The positive impact of the subsidy was confirmed for example by Bernini and Pellegrini (2011), Del Monte

and Papagni (2003) or Skuras et al. (2006), the negative impact by Criscuolo et al. (2009) and Harris and Trainor (2005). Supported enterprises showed a positive return on assets in 2014. Enterprises that drawn subsidy or were not supported had a negative ROA. It was not confirmed that this is a statistically significant difference.

According to the results it cannot be confirmed that subsidies are among factors that would significantly contribute to increasing the competitiveness of firms on the market (as measured by performance indicators).

Region

Another possible factor determining the competitiveness of companies can be explained by their locational characteristics. Therefore the last tested factor was a region, respectively location of meat enterprise and its effect on performance. Thus it is a factor over which the companies have no control. Location of enterprises may be associated with a different climate and soil quality in the case of primary production enterprises. In the case of processing enterprises, it may be more of a market infrastructure. Basic descriptive characteristics are apparent in Table 4. Statistically significant effect of the region on individual performance indicators was not a single case. Location of the enterprise cannot be considered as a factor that would affect the competitiveness of the meat industry.

Economic indicator	Subsidies	N	Mean	95% Lower Confidence Interval for Mean	95% Upper Confidence Interval for Mean	Median	Std. Deviation	P-value ANOVA
Labour productivity	Supported	40	302.34	239.83	364.85	286.94	195.46	0.246421
	Not drawing	167	234.24	192.57	275.92	201.27	272.79	
	Not supported	26	291.84	175.9	407.78	246.59	280.87	
Revenues	Supported	40	552 317.64	260 927.25	843 708.02	208 619.00	911 120.22	0.000017*
	Not drawing	167	102 974.06	39 541.44	166 406.68	7 419.00	415 188.25	
	Not supported	26	249 269.78	67 246.16	431 293.40	55 186.00	440 970.37	
Production consumption	Supported	40	500 765.44	244 356.97	757 173.91	185 920.00	801 738.69	0.000007*
	Not drawing	167	95 266.63	41 917.19	148 616.08	7 797.00	349 190.42	
	Not supported	26	226 395.58	65 279.41	387 511.75	51 951.00	390 319.98	
ROA	Supported	40	0.02	-0.01	0.05	0.03	0.08	0.728902
	Not drawing	167	-0.09	-0.22	0.05	0	0.89	
	Not supported	26	-0.06	-0.12	0.01	0.01	0.16	

Note: * Statistically significance of influence of company size on economic indicators (testing on level of significance $\alpha=0.05$). All indicators are in thousands CZK, ROA in CZK.

Source: own processing

Table 3: Descriptive statistics and one-way ANOVA for factor „Subsidies“, year 2014.

Economic indicator	Region	N	Mean	95% Lower Confidence Interval for Mean	95% Upper Confidence Interval for Mean	Median	Std. Deviation	P-value ANOVA
Labour productivity	Jihočeský	13	174.17	69.48	278.87	187.27	164.78	0.410302
	Jihomoravský	35	231.98	140.31	323.65	210.71	266.85	
	Karlovarský	5	61.28	-46.57	169.13	0	86.86	
	Královehradecký	14	186.24	86.09	286.39	189.51	173.45	
	Liberecký	7	205.93	0.43	411.42	193.33	222.19	
	Moravskoslezský	23	271.78	135.83	407.74	232.7	314.4	
	Olomoucký	5	196	-38	430.01	191.74	188.46	
	Pardubický	14	296.07	182.57	409.56	255.76	196.57	
	Plzeňský	10	309.62	122.24	496.99	332.47	261.93	
	Praha	20	386.03	151.99	620.07	222.9	500.07	
	Středočeský	30	241.02	160.87	321.18	245.35	214.66	
	Ústecký	12	169.08	66.98	271.18	181.82	160.69	
	Vysočina	19	307.69	208.9	406.49	291	204.98	
Zlínský	26	255.59	175.02	336.17	237.84	199.48		
Revenues	Jihočeský	13	424,958.17	-457,665.92	1,307,582.26	7134.5	1,389,150.45	0.61708
	Jihomoravský	35	97,295.61	29,680.49	164,910.74	6,640	196,834.81	
	Karlovarský	5	31,333.4	-5,609.32	68,276.12	26,103	29,752.59	
	Královehradecký	14	108,493.25	119.24	216,867.26	13,252.5	187,698.71	
	Liberecký	7	70,592.29	-12,030.85	153,215.43	48,215	89,337.21	
	Moravskoslezský	23	106,896.13	34,120.74	179,671.52	16,741	168,293.09	
	Olomoucký	5	205,299.8	-103,781.62	514,381.22	78,141	248,925.17	
	Pardubický	14	184,567.21	-60,314.4	429,448.83	64,467	424,123.49	
	Plzeňský	10	455,324.45	-150,988.67	1,061,637.57	34,106.75	847,567.3	
	Praha	20	171,577.05	30,405.2	312,748.9	22,134.25	301,639.96	
	Středočeský	30	191,129.7	33,106.79	349,152.61	28,542.25	423,193.13	
	Ústecký	12	56,677.5	-13,239.88	126,594.88	20,384.5	110,042.04	
	Vysočina	19	420,495.63	-133,735.25	974,726.52	26,917	1,149,893.41	
Zlínský	26	245,741.56	61,181.49	430,301.62	50,240.5	456,935.06		

Note: * Statistically significance of influence of company size on economic indicators (testing on level of significance $\alpha=0.05$). All indicators are in thousands CZK, ROA in CZK.

Source: own processing

Table 4: Descriptive statistics and one-way ANOVA for factor „Region“.

Economic indicator	Region	N	Mean	95% Lower Confidence Interval for Mean	95% Upper Confidence Interval for Mean	Median	Std. Deviation	P-value ANOVA
Production consumption	Jihočeský	13	348,246.33	-369,264.65	1,065,757.32	9,779.25	1,129,281.11	0.629967
	Jihomoravský	35	91,456.44	28,035.67	154,877.22	14,697	184,624.61	
	Karlovarský	5	28,587.4	-4976.1	62,150.9	23,329	27,031.07	
	Královehradecký	14	101,771.18	-737.25	204,279.61	9,698	177,539.8	
	Liberecký	7	62,682.71	-4,691.69	130,057.12	41,613	72,849.34	
	Moravskoslezský	23	118,401	34,907.05	201,894.95	14,911	193,079.76	
	Olomoucký	5	296,308.2	-207,044.9	799,661.3	64,556	405,385.92	
	Pardubický	14	172,116.04	-60,906.58	405,138.65	51,620.5	403,584.26	
	Plzeňský	10	428,197.2	-154,053.69	1,010,448.09	29,998.25	813,930.62	
	Praha	20	147,164.1	23,353.61	270,974.59	13,259.75	264,544.19	
	Středočeský	30	165,583.68	29,857.4	301,309.96	24,062	363,481.65	
	Ústecký	12	57,139.54	-8,047.79	122,326.87	18,863	102,597.48	
	Vysočina	19	358,944.55	-109,449.82	827,338.92	23,397	971,803.66	
	Zlínský	26	226,954.5	59,201.72	394,707.28	50,536	415,323.48	
ROA	Jihočeský	13	-0.04	-0.23	0.14	0.02	0.29	0.731963
	Jihomoravský	35	-0.03	-0.1	0.05	0.02	0.23	
	Karlovarský	5	-0.14	-0.82	0.55	0	0.55	
	Královehradecký	14	0	-0.07	0.06	-0.02	0.11	
	Liberecký	7	0.02	-0.07	0.1	0.02	0.09	
	Moravskoslezský	23	0.03	-0.04	0.11	0.01	0.18	
	Olomoucký	5	-0.02	-0.18	0.14	0.01	0.13	
	Pardubický	14	-0.01	-0.17	0.14	-0.01	0.28	
	Plzeňský	10	-0.01	-0.04	0.03	0	0.05	
	Praha	20	-0.55	-1.7	0.6	0.03	2.46	
	Středočeský	30	-0.08	-0.25	0.08	0.03	0.45	
	Ústecký	12	-0.04	-0.17	0.09	0.01	0.21	
	Vysočina	19	0.04	-0.03	0.12	0.02	0.16	
	Zlínský	26	-0.01	-0.04	0.03	0	0.08	

Note: * Statistically significance of influence of company size on economic indicators (testing on level of significance $\alpha=0.05$). All indicators are in thousands CZK, ROA in CZK.

Source: own processing

Table 4: Descriptive statistics and one-way ANOVA for factor „Region“ (Continuation).

Cluster analysis

Another objective was to find a group of meat industry companies that perform similar market behaviour and thus to identify groups of companies that can be considered endangered, or they have a key position on the market. Enterprises have been classified into four clusters. Because of the extent there is no dendrogram in the article but only a verbal description. More detailed results of the cluster analysis are therefore available on request from the authors of the article.

There were 7 companies grouped in the first cluster. There were only large enterprises. Five of them have drawn subsidies and those were mainly from the group with other ownership (company owned by various people). According to previous analysis we can suggest a strong position of this group on a market, which also pose a potential threat for other groups with regard to the fact that

large companies have shown the best performance characteristics. It was also shown that companies which have drawn subsidy achieve higher sales than unsupported businesses.

The second cluster includes only two large companies whose economical results have surpassed other businesses. Companies have a corporate owner and because of their economical results they are key players on the market.

The third cluster includes 25 companies. These are mainly enterprises with other ownership (56%), which are medium size (60% of enterprises) and 44% of them did not draw subsidies. Medium-sized businesses get closer to large enterprises with their results. Size is a factor limiting the competitiveness on the Czech market and that is why this group has the potential to develop its opportunity to compete with the previous two clusters.

The last largest cluster is a group of 199 enterprises made up by 36% of businesses owned by various persons, and 32% of family businesses. These are mainly small and micro enterprises (total 89% of enterprises), which did not apply for support (77% of enterprises). Micro and small enterprises performed the lowest values of indicators as well as the unsupported businesses. The position of these enterprises on the Czech market may be endangered to a certain level. Since these are small sized businesses, we can assume that their philosophy (ideas about visions and goals) is totally different than in the case of large enterprises. Small businesses can face their production to local customers and compete with other local processors. Especially because of the form of sales and the access to specific markets they have the advantage that large companies are missing and might not even be interested in these markets (preference of sold amount).

Conclusion

The main aim of the article was to identify qualitative factors that limit the competitiveness of enterprises of the meat industry on the Czech market. Size of the company, ownership, use of support and region were considered. It was confirmed that better performance characteristics are shown by large enterprises. Differences among the companies were significantly different so the size of a company can be stated as a factor limiting competitiveness. Foreign-owned enterprises can be evaluated as the most powerful according to the business ownership. These differences were statistically significantly different only in indicators of revenues and production consumption. Therefore competitiveness is not determined by the form of ownership. It was confirmed that the enterprises which were supported by grants tend to have improved performance indicators. Statistically significant differences were confirmed only for revenues and production consumption. Therefore it cannot be confirmed that subsidies are among factors that would contribute to increase the competitiveness of enterprises, as well as a location of company (statistically significant differences in indicators did not show in any single case).

Four groups of companies that exhibit similar characteristics operating on the Czech market were identified according to cluster analysis. Two key groups of players on the market were identified from these clusters. This is a group of large

companies that exhibit superior performance characteristics and are a potential threat for other groups on the market. The potential for the development or being a competition to these groups have businesses of the third cluster (consisting primarily of medium-sized companies that exhibit values very close to large enterprises). The largest group is the cluster formed by micro and small enterprises which did not apply for support. Their position on the market can be influenced by other clusters to some degree. However, these companies might have different goals than large businesses and focus more on local consumers.

Where were used various approaches to analyse economic situation in meat industry. It is hard to compare the same problematic as in this paper. Mijic et al. (2014) used wide portfolio of financial analysis indicators to evaluate meat industry. They indicated the low return on investment, profitability, liquidity, and high debt of the companies in the meat industry in Serbia. The companies in the meat-processing industry had better performance than livestock producers and this difference is statistically significant. With these authors we can compare ROA, which was 11.08% in 2012, in our sample of processing companies was much lower (depends on company's type). Martin et al. (2015) used to evaluate the economic and financial health of the meat industry companies, by financial ratios Price to earnings ratio, profit margin, debt to equity, and return on equity. The ratios were compared to the ratios of the top 15 industries. For three of the four key financial ratios that were tested, meat industry firms on average performed significantly weaker than the top 15 industries. Debt to equity ratio showed the meat firms to be about the same as the top 15 industries. Financially and economically, the meat firms were not as strong as the average firm in the top 15 industries.

Wijnands et al. (2007) dealt with competitiveness of sub-sectors food industry. The EU is a leading exporter of meat, net exporter for pork and poultry and net importer for beef. The trade balance in meat for the EU developed negatively, he surplus decreased. The EU has a negative trade balance for beef. Author recommended to focus on the production of fresh products for the demanding European customer. The competitiveness of the EU meat industry is weak. Third countries like Brazil and Argentina have competitive advantages (large and reliable livestock supplies, low costs of labour and feed combined with economies of scale). The need

for consolidation will be a key issue in the meat industry mergers to achieve economies of scale. Only bigger companies with an adequate scale can exploit the opportunity to cater for the various preferences for meat cuts between countries.

Banterle and Carraresi (2006) applied cluster analysis to highlight groups of countries with similar features in meat industry. The competitiveness was presented by RCA and NEI indexes. Good competitive performance in the meat sector was observed in Italy, Spain, Ireland and Austria, all were found to be specialised in the sector and export oriented. Germany and France showed positive competitive performance, but a high level of intra - industry trade and low specialisation. Denmark was characterized by negative dynamics of competitiveness even though there were high exports in the sector; a similar trend is observed in Belgium and the Netherlands. The rest of the countries show weak

competitiveness for the analysed sector. The type of exported product varies greatly also. Italy and Spain export dried or smoked swine meat, whereas Germany and Denmark export mainly sausages and preserved meat. Krystallis and Arvanitoyannis (2006) used also cluster analysis to analyse meat industry in Greece, but to define consumer types in relation to meat quality perceptions.

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References

- [1] Bakucs, L., Latruffe, L., Fertő, I. and Fogarasi, J. (2010) „Impact of EU accession on farms technical efficiency in Hungary“, *Post-Communist Economies*, Vol. 22, No. 2, pp. 165-175. ISSN 1465-3958. DOI 10.1080/14631371003740639.
- [2] Baguley, T. (2012) „Calculating and graphing within-subject confidence intervals for ANOVA“, *Behavior Research Methods*, Vol. 44, No. 1, pp. 158-175. ISSN 1554-3528. DOI 10.3758/s13428-011-0123-7.
- [3] Banterle, A. and Carraresi, L. (2006) “International Trade and Competitiveness Analysis in the European Union: the Case of Prepared Meat Sector“, In: *98th EAAE Seminar Marketing Dynamics within the Global Trading System: New Perspectives*, Chania, Crete, Greece as in: 29 June – 2 July, 2006.
- [4] Bennani, Y. and Benabdeslem, K. (2006) „Dendogram-based SVM for multi-class classification. CIT“, *Journal of Computing and Information Technology*, Vol. 14, No. 4, pp. 283-289. ISSN 1846-3908.
- [5] Berman, S. L., Wicks, A. C., Kotha, S. and Jones, T. M. (1999) „Does stakeholders orientation matter? The relationship between stakeholder management models and firm financial performance“, *Academy of Management Journal*. Vol. 42, No. 5, pp. 488-506. ISSN 1948-0989. DOI 10.2307/256972.
- [6] Bernini, C. and Pellegrini, G. (2011) „How are growth and productivity in private firms affected by public subsidy? Evidence from a regional policy“, *Regional Science and Urban Economics*, Vol. 41, No. 3, pp. 253-265. ISSN 0166-0462. DOI 10.1016/j.regsciurbeco.2011.01.005.
- [7] Bigliardi, B. and Galati F. (2013) „Innovation trends in the food industry: The case of functional foods“, *Trends in Food Science & Technology*, Vol. 31, No. 2, pp. 118–129. ISSN 0924-2244. DOI 10.1016/j.tifs.2013.03.006.

- [8] Brase, Ch. H. and Brase, C. P. (2016) „*Understanding Basic Statistics*“, Cengage Learning, Boston, USA. ISBN 978-1-305-87349-0.
- [9] Buckwell, A. and Davidova, S. (1993) „Potential implications for productivity of land reform in Bulgaria“, *Food Policy*, Vol. 18, No. 6, pp. 493-506. ISSN 0306-9192. DOI 10.1016/0306-9192(93)90006-W.
- [10] Cardinal, N. and Aitken, M. R. F. (2006) „*ANOVA for the behavioral sciences researcher*“, Lawrence Erlbaum Associates, New Jersey, USA. ISBN 0-8058-5586-6.
- [11] Carroll, J., Greene, S., O'Donoghue, C., Newman, C. and Thorne, F. (2009) „Productivity and the Determinants of Efficiency in Irish Agriculture (1996-2006), In: *The 83rd Annual Conference of the Agricultural Economics Society*, Dublin, Ireland, 30 March-1 April.
- [12] Criscuolo, C., Martin, R., Overman, H. and Van Reenen, J. (2009) „The Causal Effects of an Industrial Policy“, NBER Working Paper, No. 17842, National Bureau of Economic Research, Cambridge.
- [13] Čechura, L. and Hockmann, H. (2010) „Sources of economic growth in the Czech food processing“, *Prague Economic Papers*, Vol. 2, pp. 169-182. ISSN 2336-730X.
- [14] Del Monte, A. and Papagni, E. (2003) „R&D and the growth of firms: empirical analysis of a panel of Italian firms“, *Research Policy*, Vol. 32, No. 6, pp. 1003–1014. ISSN 0048-7333. DOI 10.1016/S0048-7333(02)00107-5.
- [15] Food Drink Europe (2015) „European Food and Drink Industry 2014-2015“. [Online]. Available: http://www.fooddrinkeurope.eu/uploads/publications_documents/Data_and_Trends_2014-20151.pdf [Accessed: 20 Sep 2016].
- [16] Gorton, M. and Davidova, S. (2004) „Farm productivity and efficiency in the CEE applicant countries: A synthesis of results“, *Agricultural Economics*, Vol. 30, No. 1, pp. 1-16. ISSN 1574-0862. DOI 10.1111/j.1574-0862.2004.tb00172.x.
- [17] Habib, A. (2006) „Disaggregated earnings and prediction of future profitability: evidence from industrial groups in Japan“, *Review of Accounting and Finance*, Vol. 5, No. 4, pp. 355-369. ISSN 1475-7702. DOI 10.1108/14757700610712435.
- [18] Hall, B. and LeVeen, P. (1978) „Farm size and economic efficiency: The case of California“, *American Journal of Agricultural Economics*, Vol. 60, No. 4, pp. 589-600. ISSN 1467-8276. DOI 10.2307/1240243.
- [19] Harris, R. and Trainor, M. (2005) „Capital Subsidies and Their Impact on Total Factor Productivity: Firm-level Evidence from Northern Ireland“, *Journal of Regional Science*, Vol. 45, No. 1, pp. 49–74. ISSN 1467-9787. DOI 10.1111/j.0022-4146.2005.00364.x.
- [20] Hockmann, H., Levkovych, I. and Grau, A. (2013) „Review of recent developments in the agri-food sector“. COMPETE Working Papers. [online]. Available: http://www.competeproject.eu/fileadmin/compete/files/working_paper/COMPETE_Working_Paper_1_Recent_developments.pdf [Accessed: 10 Sep 2016].
- [21] Kislingerová, E. (2008) „*Inovace nástrojů ekonomiky a managementu organizací*“ (Innovation of tools of economic and management organizations - in Czech), C. H. Beck, Prague. ISBN 978-80-7179-882-8.
- [22] Krystallis, A. and Arvanitoyannis, I. S. (2006) „Investigating the concept of meat quality from the consumers' perspective: The case of Greece“, *Meat Science*, Vol. 72, No. 1, pp. 164-176. ISSN 0309-1740. DOI 10.1016/j.meatsci.2005.06.013.
- [23] Lambarraa, F., Stefanou, S., Sarra, T. and Gil, J. (2009) „The impact of the 1999 CAP reforms on the efficiency of the COP sector in Spain“, *Agricultural Economics*, Vol. 40, No. 3, pp. 355-364. ISSN 1574-0862. DOI 10.1111/j.1574-0862.2009.00378.x.

- [24] Latruffe, L. (2010) "Competitiveness, Productivity and Efficiency in the Agricultural and Agri-Food Sectors", *OECD Food, Agriculture and Fisheries Papers*, No. 30, OECD Publishing. ISSN 1815-6797.
- [25] Latruffe, L., Balcombe, K., Davidova, S. and Zawalinska, K. (2004) „Determinants of technical efficiency of crop and livestock farms in Poland“, *Applied Economics*, Vol. 36, No. 12, pp. 1255-1263. ISSN 1466-4283. DOI 10.1080/0003684042000176793.
- [26] Liargovas, P. and Skandalis. K. (2010) „Factors Affecting Firm Competitiveness: The Case of Greek Industry“, *Global Business and Management Research - An International Journal*, Vol. 2, No. 2, pp. 184-197. ISSN 1947-5667.
- [27] Martin, H. M., Smith, K. T. and Smith, M. (2015) „A Financial and Public Policy Analysis of the Meat Industry“. [Online]. Available: <https://ssrn.com/abstract=2618753>. [Accessed: 15 Sep 2016]. DOI 10.2139/ssrn.2618753.
- [28] Mathijs, E., Dries, L., Doucha, T. and Swinnen, J. (1999) „Production efficiency and organization of Czech agriculture“, *Bulgarian Journal of Agricultural Science*, Vol. 5, No. 2, pp. 312-324. ISSN 1310-0351.
- [29] Mijić, K., Zekić, S., Jakšić, D. and Vuković, B. (2014) „Meat industry in Serbia: performance analysis of meat-processing and livestock companies“, *Custos e @gronegocio on line*, Vol. 10, No. 3, pp. 124-144. ISSN 1808-2882.
- [30] Ministry of Agriculture (2014) „Panorama of Food Industry 2013“ [Online]. Available: <http://eagri.cz/public/web/mze/ministerstvo-zemedelstvi/vyrocní-a-hodnotící-zpravy/panorama-potravinarskeho-prumyslu/panorama-potravinarskeho-prumyslu-2013.html> [Accessed 10 Sep 2016].
- [31] Medonos, T., Ratinger, T., Hruška, M. and Špička, J. (2012) „The Assessment of the Effects of Investment Support Measures of the Rural Development Programmes: the Case of the Czech Republic“, *Agris on-line Papers in Economics and Informatics*, Vol. 4, No. 4, pp. 35-47. ISSN 1804-1930.
- [32] Mejstříková, L., Mezera, J. and Plášil, M. (2011) „Positive and Negative Aspects of Financial Economic Development in Selected Branches of the Food Industry of the CR in 2007-2009 as Revealed by Spider Analysis“, *Agris on-line Papers in Economics and Informatics*, Vol. 3, No. 2, pp. 39-54. ISSN 1804-1930.
- [33] Menrad K. (2004) „Innovations in the food industry in Germany“, *Research Policy*, Vol. 33, No. 6, pp. 845-878. ISSN 0048-7333. DOI 10.1016/j.respol.2004.01.012.
- [34] Meric, G., Welsh, C., Weidman, S. and Marmon, R. (2011) „The Effects of the 2008 Stock Market Crash on the Managerial Behavior, Financial Characteristics and Competitiveness of Large U. S. Corporations“, *Journal of Global Business Issues*, Vol. 5, No. 1, pp. 11-20. ISSN 1931-311X.
- [35] Munroe, D. (2001) „Economic efficiency in Polish peasant farming: An international perspective“, *Regional Studies*, Vol. 35, No. 2, pp. 461-471. ISSN 1360-0591. DOI 10.1080/00343400123499.
- [36] O’Neill, S. and Matthews, A. (2001) „Technical efficiency in Irish agriculture“, *The Economic and Social Review*, Vol. 32, No. 3, pp. 263-284. ISSN 12-9984.
- [37] Putíčová, M. and Mezera, J. (2008) „Food industry in the Czech Republic – with regard to labour force development“, *Agricultural Economics*, Vol. 54, No. 6, pp. 285-292. ISSN 1805-9295.
- [38] Rasmussen, E. M. (1992) „Clustering Algorithms. Information retrieval: data structures and algorithms“, Prentice-Hall, Inc., New Jersey, USA. ISBN 0-13-463837-9.
- [39] Rossi, F. and Mirtchev, V. (2016) „Statistics for Food Scientists“, Academic Press, San Diego, USA. ISBN 9780124171794.
- [40] Santis. P. Albuquerque, A. and Lizarelli, F. (2016) „Do sustainable companies have a better financial performance? A study on Brazilian public companies“, *Journal of Cleaner Production*, Vol. 133, No. 1, pp. 735-745. ISSN 0959-6526. DOI 10.1016/j.jclepro.2016.05.180.

- [41] Schiefer, J. and Hartman, M. (2008) „Determinants of competitive advantage for German food processors“, *Agribusiness*, Vol. 24, No. 3, pp. 306-319. ISSN 1520-6297. DOI 10.1002/agr.20168.
- [42] Skuras, D., K. Tsekouras, Dimara. E. and Tzelepis. D. (2006) „The Effects of Regional Capital Subsidies on Productivity Growth: A Case Study of the Greek Food and Beverage Manufacturing Industry“, *Journal of Regional Science*, Vol. 46, No. 355-381. ISSN 1467-9787. DOI 10.1111/j.0022-4146.2006.00445.x.
- [43] Špička, J. and Krause, J. (2013) „Selected socioeconomic impact of public support for agricultural biogas plants: the case of the Czech republic“, *Bulgarian Journal of Agricultural Science*, Vol. 19, no. 5, pp. 929-938. ISSN 1310-0351.
- [44] Tangen, S. (2003) „An overview of frequently used performance measures“, *Work Study*, Vol. 52, No. 7, pp. 347-354. ISSN 0043-8022. DOI 10.1108/00438020310502651.
- [45] Wijnands J. H. M., Van der Meulen B. M. J. and Poppe K. J. (2007) „*Competitiveness of the European Food Industry, An economic and legal assessment*“. Luxembourg: European Commission. ISBN 978-92-79-06033-5.
- [46] Zhu, X., Demeter, R. and Oude Lansink, A. (2008) „Competitiveness of Dairy Farms in Three Countries: The Role of CAP Subsidies“, In: *12th Congress of the European Association of Agricultural Economists*, Gent, Belgium, 27-30 August.