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CZECH AND POLISH SUGAR INDUSTRY – CONCENTRATION OF SUGAR PRODUCTION

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ABSTRACT

The sugar industry, as one of the most regulated food industries in the EU, has been given great challenge due to the sugar quota elimination in 2017. Both in the Czech Republic and Poland, sugar industry underwent significant transformation over last 20 years and mainly after the EU accession. Due to EU's 2006 sugar reform led to significant reduction in number of production facilities. In both countries, we observed improved production of sugar beet driven equally by intensification and extensification in Poland and by extensification forces in the Czech Republic. Reduction in number of refineries also decreased number of competitors which led to market concentration. Conducted Herfindahl-Hirschman analyses proved, that Polish market face lower level of concentration in comparison to Czech market, which is dominated mainly by Tereos TTD and Moravskoslezke curkovary. Even though Krajowa Spółka Cukrowa also dominate the Polish market, other producers also take advantage of their position. KSC is under the increasing competition of German sugar producers (Südzucker Polska; Pfeifer&Langen; Nordzucker Polska).

Keywords: Czech Republic, Poland, sugar, industry, markets, production, concentration, Herfindahl-Hirschman index
JEL code: Q13

INTRODUCTION AND THEORETICAL BACKGROUND

The sugar industry, as one of the most regulated food industries in the EU, has been given great challenge due to the sugar quota elimination in 2017. Estimation of further market development has been done by multiple authors (Heno et al., 2017; Hryszko and Szajner, 2017; Kovarova et al., 2017). Both in the Czech Republic and Poland, sugar industry underwent significant transformation over last 20 years and mainly after the EU accession and 2006 sugar reform of the EU which led to elimination of beet sugar production in multiple countries (Bulgaria, Ireland, Latvia, Portugal – mainland and Slovenia; EC, 2009). In the Czech Republic and Poland, sugar production

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was not fully eliminated, but changes in conditions under common market of the EU led to significant reduction in number of production facilities.

On the other hand, reforms led to increased efficiency and intensity in production (Benešová et al., 2015; Artyszak et al., 2017; Molas et al. 2017). Contrary to improved situation in production efficiency, sugar reforms led to market concentration in the EU and the market is becoming more and more dominated by few players mainly from Germany, France, Netherlands (Rezbova et al., 2015). According to Smutka et al. (2015) present European sugar market have led to market failure when nearly as 10 million tonnes of the production quota (75%) is controlled by five multinational companies – Südzucker, Nordzucker, Pfeifer&Langen (all from Germany), Tereos (FR) and Associated British Foods (UK). Results of empirical investigation presented by Aragrande et al. (2017) shows that vertical price transmission asymmetries still exist after the reform, which in turn contributed to increase sugar sector concentration.

In such a strong concentration exists potential for so called monopolistic margins, where first (agricultural producers) and last (consumers) parts of the chain are characterised by very high number of participants and potentially the weakest bargaining power (Hamulczuk and Szajner, 2015). Under sugar regime of the EU, beet production generated a relative stable income compared to other crops as historically EU guaranteed sugar beet price for farmers as EUR 43.63/ /tonne and EUR 26.29/tonne from 2009 onwards. As beet quotas were abolished, high price volatility in a free market is expected as a result (Hanse et al., 2018) which will result in additional pressure on least integrated individuals – producers and consumers. Assessment of concentration on site of sugar producers is one of the main aims of this contribution.

MATERIALS AND METHODS

Main aim of presented contribution is to identify main differences in the Czech and Polish sugar industry connected to industry development between 2000 and 2017 and assess concentration on selected markets. Own analyses is based on comparison of secondary data sourced from Czech and Polish sources (Institute of Agricultural and Food Economics – National Research Institute, Agricultural Market Agency, Ministry of Agriculture and Rural Development, Central Statistical Office of Poland – GUS; Czech Statistical Office – CZSO, Czech Ministry of Agriculture), Eurostat and F.O. Licht database.

For the purpose of own analyses, the following categories of data are observed: (i) sugar beet production characteristics (area, yield, total production); (ii) characteristics of sugar industry (number of refineries, allocation of production quotas, processing capacity); (iii) companies' financial statements.

The development over time is analysed by using simple statistical indicator such as Average Annual Growth Rate (AAGR) based on geometric mean. The calculation was done as follows:

$$AAGR_{GEO} = (X_n/X_0)^{1/n} - 1 \qquad (1)$$

The concentration of production capacities is analysed from the point of view of all Czech and Polish sugar producers. This analysis is based on application of Herfindahl-Hirschman index (further referred as HHI). HHI is able to measure the market concentration of the industry. HHI is calculated as follows:

$$HHI = \sum_{i=1}^{N} s_i^2 = s_1^2 + s_2^2 + s_3^2 + \ldots + s_n^2 \qquad (2)$$

where:

s_i – market share of corporation,
i – sugar production,
N – total amount of corporations operating on the relevant market in the given country.

According to Hirschman (1964), HHI ranges between 0 and 10,000, while values close to 0 indicates no concentration and high competitiveness of the market; while 10,000 indicates low level of competition and signalise monopoly. Methodology used by U.S. Department of Justice and Federal Trade Commission (2010) indicates: (i) highly competitive environment for values below 100; (ii) non-concentrated environment where operates number of important sugar companies for HHI below 1,500; (iii) market with monopolistic competition and significant concentration with HHI above 2,500. The more HHI ap-

proaches 10,000, the more concentrated and monopolistic the marker is.

RESULTS AND DISCUSSION

In the Czech Republic and Poland, significant changes could be observed in relation to sugar beer production. Table 1 presents changes connected to total harvested area. In Poland, 333 thousand ha were utilised for sugar beet purposes in 2000, which represented about 2.37% of total arable land. Between 2000 and 2009, the total production area decreased by 133 thousand ha (–40%), while total production of beet (Table 2) changed only by 17% as decreased from 13 million tonnes to 10.8 million tonnes during the same period. After 2006 sugar and quota reform of the EU, which means after 2009 in Poland as the reform was concluded, total harvested area remains relatively constant and oscillate close to 200 thousand h. Total production does not remains as stable as sown area mainly due to different climatic conditions. Therefore total beet production ranges between 9.3 million tonnes (2015) and 13.9 million tonnes (2017). Mainly due to the changes connected to EU accession and 2006 reform, long term trend in harvested area is negative (average annual growth rate: –2.41%), while

Table 1. Sugar beet – harvested area and share on arable land

Producer		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PL	harvested area (thous. ha)	333	317	303	286	297	286	262	247	187	200
	share on arable land (%)	2.37	2.26	2.32	2.28	2.36	2.37	2.12	2.10	1.56	1.67
CZ	harvested area (thous. ha)	61.3	77.7	77.5	77.3	71.1	65.6	61	54.3	50.4	52.5
	share on arable land (%)	1.98	2.52	2.79	2.81	2.61	2.42	2.31	2.07	1.94	2.03
×		2010	2011	2012	2013	2014	2015	2016	2017	AAGR (%)	
PL	harvested area (thous. ha)	206	203	212	194	198	180	206	220	–2.41	
	harvested area (thous. ha)	1.89	1.84	1.95	1.80	1.82	1.65	1.91	n/a	–1.35	
CZ	harvested area (thous. ha)	56.39	58.33	61.16	62.4	62.96	57.61	60.74	66.1	0.44	
	harvested area (thous. ha)	2.21	2.31	2.43	2.49	2.53	2.31	2.43	n/a	1.30	

Source: Institute of Agricultural and Food Economics ─ National Research Institute (2001–2017); Czech Ministry of Agriculture (2018).

Table 2. Sugar beet – total production (thous. tonnes)

Producer	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PL	13 134	11 364	13 432	11 739	12 730	11 912	11 475	12 682	8 715	10 849
CZ	2 809	3 529	3 833	3 495	3 579	3 496	3 138	2 890	2 885	3 038
×	2010	2011	2012	2013	2014	2015	2016	2017	AAGR (%)	
PL	9 973	11 674	12 350	11 234	13 489	9 364	13 500	13 900	0.33	
CZ	3 065	3 899	3 869	3 744	4 425	3 421	4 118	4 399	2.67	

Source: Institute of Agricultural and Food Economics ─ National Research Institute (2001–2017); Czech Ministry of Agriculture (2018).

positive trend in total production (AAGR: +0.33%) and yield (Table 3) is observed (AAGR: +2.8%). The rapid changes in the beet production could be demonstrated mainly by increased yield. While in 2000 only 39.4 tonnes/ha of beet was harvested, in 2014 producers reached maximum yield of 68.3 tonnes/ha (+73%).

In the Czech Republic, 61.3 thousand ha were utilised for sugar beet purposes in 2000, which represented about 1.98% of total arable land. Between 2000 and 2008, the total production area decreased by 12 thousand ha (–18%), while total production of beet did not changed (2.8 in 2000 vs. 2.8 million tonnes in 2008). While in above mentioned referred period in Poland production suffered, loss of land was compensated in the Czech Republic by increase in productivity as yield increased by 25%. After sugar and quota reform of the EU, which means after 2008 in the Czech Republic as the reform was concluded and Eastern Sugar changed production quota for monetary compensations, total harvested area steadily increases and exceeded original 2000 value in 2013 (62.4 thousand ha).

Total production never really felt below 2000 values and it goes up by 2.6% per annum. In 2017, record high production of beet was observed as production reached almost 4.4 million tonnes (+57% to year 2000). Mainly due to the changes connected to EU accession and 2006 reform, long term trend in harvested area is below 0.5%, while positive trend occurs in total production (AAGR: +2.67%) and yield (AAGR: +2.2%). Increased harvested area is seen as the main influencer of the total production change in the Czech Republic (results based on logarithmic dissolution of factors), which indicates that Czech sugar beet production is driven by extensification. In Poland, both forces (influence of yield and area) are relatively equal and therefore change in production is driven by both extensification as well as intensification.

In both markets, significant reduction of sugar refineries occurred. In Poland, total reduction was from original 71 in 2001 to 18 after year 2009 (–75%). In the Czech Republic, total number of refineries was already reduced between 1989 and 2000 (–38 refineries), so after EU accession and 2006 reform only four refineries were closed. This closure was connected mainly to quota renunciations proposed by 2006 reform. The Eastern Sugar closed 3 refineries, gave up quota of about 102 thousand tonnes (Table 6, 18% of national quota) and received over EUR 74 million (102 thousand × 730). In Poland, total quota renunciation was 366,838 tonnes that resulted in payment of more than EUR 280 million from EU restructuring fund (Ministry of Agriculture and Rural Development, 2011). Total production quota decreased in the Czech Republic and Poland by 18 and 16% respectively. After all, in Poland remained 4 producers running abovementioned 18 refineries – Krajowa Spółka Cukrowa (7×); Südzucker Polska (5×); Pfeifer&Langen (4×); Nordzucker Polska (2×). In the Czech Republic, 5 subjects run 7 refineries: Tereos TTD (2); Moravskoslezské cukrovary (2); Cukrovar Vrbátky (1); Litovelská cukrovarna (1); Hanácká potravinářská společnost (1).

Table 3. Sugar beet – yield (100 kg/ha)

Producer	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PL	394	358	443	410	428	416	438	513	465	543
CZ	458	454	495	452	503	533	514	532	572	579
×	2010	2011	2012	2013	2014	2015	2016	2017	AAGR (%)	
PL	483	574	582	580	683	520	655	630	2.8	
CZ	544	668	633	600	703	594	678	666	2.2	

Source: Institute of Agricultural and Food Economics ─ National Research Institute (2001–2017); Czech Ministry of Agriculture (2018).

Table 4. Number of sugar refineries

Producer	2001	2002	2003	2004	2005	2006	2007	2008	2009 and further
PL	76	65	57	43	40	31	29	19	18
CZ	14	13	13	11	11	10	7	7	7

Source: Institute of Agricultural and Food Economics ─ National Research Institute (2000–2017); Czech Ministry of Agriculture (2017).

Table 5. National production quotas

Producer	2004/05		2005/06		2006/07	2007/08	2008/09 and further
CZ	441.2 (A)	13.7 (B)	423.0 (A)	13.1 (B)	454.9	369.9	372.5
PL	1 580.0 (A)	91.9 (B)	1 495.3 (A)	87.0 (B)	1 671.90	1 772.50	1 405.60

Source: Institute of Agricultural and Food Economics ─ National Research Institute (2000–2017); Czech Ministry of Agriculture (2017).

Table 6. Total raw sugar production and average production per refinery

Producer	2006/07	2008/09	2010/11	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	AAGR (%)
	Total raw sugar production									
CZ	498	458	517	612	593	632	512	650	695	3.1
PL	1 883	1 427	1 613	2 030	1 959	2 168	1 652	2 278	2 387	2.2
×	Average production per refinery (1,000 tonnes)									
CZ	50	65	74	87	85	90	73	93	99	6.5
PL	61	75	90	113	109	120	92	127	133	7.4

Source: author based on F.O. Licht (2017).

As seen from Table 5, total production of sugar is related to increase in total production of sugar beet. As production of beet goes up, total production of raw sugar increases. We can observe 2 phenomenon – increased in total production which goes up annually in average by 3.1 and 2.2% in the Czech Republic and Poland respectively, while average growth rate of raw sugar production per one refinery increases much faster (6.5 and 7.4%). According to F.O. Licht's Annual reports (2016, 2017) production in Poland ought to exceed 2.3 million tonnes of raw sugar (2.1 million tonnes of white sugar), while in 2006/2007 it was half million tonnes less. Production in Czech Republic approaches 700 thousand tonnes of raw sugar (640 thousand tonnes of white sugar), while in 2006/2007 it was 200 thousand tonnes less. Second part of Table 6 illustrates average production per one refinery. Increasing trend is connected to investments into new and more efficient technologies, storage facilities as well as prolongation of sugar campaign. Czech refineries are in general smaller than Polish entities. Table 7, see column processing daily capacity, also

illustrates this fact. Average Czech processing capacity per refinery approaches 5,600 tonnes per day, while in Poland this value equals to 7,000 tonnes/day. But, it is worth mentioning, that Tereos TTD has 2 large production facilities, one with capacity of 15 (in Dobrovice) and 7 (in Ceske Mezirici) thousand tonnes of beet per day. The largest Polish refinery is able to process about 12,000 tonnes a day (Glinojeck, P&L), while smallest does not goes below 4,000 tonnes per day. In the Czech Republic, the smallest has capacity of about 2,400 tonnes/day.

Described situation describes market concentration calculations presented in Table 8. They presents calculation of Herfindahl-Hirschman Index (HHI) based on different concentration indicators. The concentration is measured based on daily processing capacity, allocated production quotas, revenues and total sugar production. Mean index clearly states, that in the Czech Republic, total concentration of sugar markets is closer to monopolistic competition as average HHI index reached 3,782. The fact is given by position of Tereos TTD, which is dominating force on the Czech Market, representing 58% of processing capacity and from 49–59% of quotas, revenues and production. Moravskoslezské cukrovary is the second dominant subjec. Both control about 80% of the sugar production and form duopoly. While Krajowa Spółka Cukrowa, Polish State owned enterprise, is also dominating the market, its dominance in relation to competitors is not so significant. It only represents about 48% in processing capacity, and between 36–39 in quotas, revenues and sugar production. Other players (mainly Südzucker Polska and Pfeifer&Langen) has also significant marker role with share above 25% in production. The fact balances distribution of HH points.

Table 7. Sugar producers – basic information

Producer		Σ*	Processing capacity (tonnes/day)	White sugar quota (tonnes/year)	Revenues (EUR thous.)	White sugar production (tonnes)
PL	Krajowa Spółka Cukrowa	7	60 000	549 600	429 780	685 000
	Südzucker Polska	5	21 000	351 900	183 564	522 000
	Pfeifer & Langen	4	30 000	371 700	352 104	470 000
	Nordzucker Polska	2	15 000	132 500	156 225	218 000
	Total	18	126 000 (est. 17/18)**	1 405 700 (13/14)	1 121 673 (2016)	1 895 000 (2012)
CZ	Tereos TTD	2	22 800	208 716	236 514	306 000
	Moravskoslezské cukrovary	2	8 600	93 973	124 367	194 086
	Cukrovar Vrbátky	1	2 400	21 989	26 909	45 440
	Litovelská cukrovarna	1	2 400	22 597	31 347	40 638
	Hanácká potravinářská spol.	1	3 000	25 184	25 300 (est.)***	38 000
	Total	7	39 200 (17/18)	372 459 (16/17)	444 421 (2016)	624 164 (16/17)

Note: *Σ – number of refineries; **estimation based on data from Stowarzyszenie Techników Cukrowników (Wojtczak, 2018); ***estimation based on last available revenue (2012: EUR 22,683 thousand) and its market share in revenues (5.69%).

Source: latest companies' annual reports, Institute of Agricultural and Food Economics – National Research Institute (2001–2017), Czech Ministry of Agriculture (2017); Wojtczak (2018).

Table 8. Sugar producers – concentration analyses

Producer		Processing capacity		Quota system**		Revenues*		Production***		Mean
		share (%)	HHI	share (%)	HHI	share (%)	HHI	share (%)	HHI	HHI
PL	Krajowa Spółka Cukrowa	48	2 268	39	1 529	38	1 444	36	1 307	1 637
	Südzucker Polska	17	278	25	627	16	256	28	759	480
	Pfeifer & Langen	24	567	26	699	31	961	25	615	711
	Nordzucker Polska	12	142	9	89	14	196	12	132	140
	Total	100	3 254	100	2 943	100	2 857	100	2 857	2 978
CZ	Tereos TTD	58	3 383	56	3 140	53	2 832	49	2 404	2 940
	Moravskoslezské cukrovary	22	481	25	637	28	783	31	967	717
	Cukrovar Vrbátky	6	37	6	35	6****	37	7	53	41
	Litovelská cukrovarna	6	37	6	37	7	50	7	42	42
	Hanácká potravinářská společnost	8	59	7	46	6	32	6	37	43
	Total	100	3 998	100	3 894	100	3 734	100	3 503	3 782

Note: *revenues of P&L Polska and P&L Glinoject; **Polish quota valid for marketing year 13/14 based on Kapusta (2015); ***latest Polish production available for year 2012;****value of own estimation based on 2012 financial results.

Source: author based on data from Table 9.

CONCLUSION

Presented contribution aimed to compare Czech and Polish development in Sugar industry after EU accession. Based on collected data, conducted analyses and related calculations, it could be concluded:

Sugar industry underwent significant reduction in total amount of processing facilities in both countries.

In Poland, this reduction was followed by reduction in total harvested area and production of sugar beet, but at the end of referential period all beet production indicators exceeded original 2000 values. Development of sugar beet production was driven both by intensification in yield and by extensification in harvested area.

In the Czech Republic, closure of refineries resulted in decrease of harvested area, total beet production was newer below 2,000 values and increased annually. Changes in beet production are more dependent on rise in land utilisation rather than on yield intensification.

Sugar processing industry increased average raw sugar production per one refinery by 6.5 and 7.4% in the Czech Republic and Poland respectively. Total production increased by 200 and 500 thousand tonnes in the Czech Republic and Poland between marketing year 2006/2007 and 2017/18 according to F.O. Licht's data.

Both markets could be classified as markets with monopolistic competition and significant concentration. Market dominance is much more significant in the Czech Republic where certain form of duopoly is observed.

Concentration might have impact on lest integrated units in value chain – producers and consumers. Further changes connected to liberalised internal EU market are expected. Quantification of that impact shall be conducted in forthcoming studies.

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