Polish Sugar Industry Development

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Abstract

Poland, and its sugar market, represents very specific phenomenon among countries producing primarily sugar from sugar beet. Polish sugar production is relatively high in comparison to other European countries and have not negligible export potential. Main aim of presented contribution is to identify main trends and important specifics connected to sugar industry development between years 2000 and 2017. From the analyses of Polish sugar industry and sugar market following findings could be concluded. Production of sugar beet is constantly developing toward more intensive production; mainly yield, sugar content and average cultivated area per one grower increased significantly, but still Polish producers belongs among the smallest in the whole EU. Production is also subsidised by coupled national payment of 380 EUR/ha. Polish market underwent significant restructuring that on one side resulted in significant reduction of amount of sugar refineries and sugar beet producers. On the other hand, it resulted in considerable concentration of production capacities among subjects that successfully passed the transformation phase. Despite reduction of sugar refineries from original 76 to 18, sugar beet production remained almost unchanged at the level of 12 million tonnes. Also raw sugar production remained almost unchanged and during the period oscillated around the level of 2 million tonnes. On contrary production of white sugar increased significantly from 1.54 million tonnes in 2001 to 2.1 million tonnes in 2016. Reduction of sugar refineries was in this perspective compensated by the modernisation of production facilities and increase of their processing capacities. Between 2001 and 2016 length of sugar campaign increased from average 51 days to about 112 days. The average processing capacity of one sugar refinery grew by tens of percent. At present all production capacities are controlled by only four actors (Krajowa Spolka Cukrowa S.A., Nordzucker Polska S.A., Pfeifer&Langen, Südzucker Polska S.A.). The market evince strong characteristics of oligopoly with domination of 3 subjects, state-owned Krajowa Spolka Cukrowa S.A.; Südzucker Polska S.A and Pfeifer&Langen, both owned by German capital. Polish sugar export was not harmed significantly during transformation period. Recently it oscillates around 0.5 million tonnes annually. Increasing unit price per kilogram of exported sugar is considered as positive and important factor that pushed total value of exports to approximately 240 million EUR. Extreme territorial concentration is seen as a weak point of Polish sugar foreign trade. Top 10 countries participate on Polish exports and imports with sugar approximately by 72.56% and 92.94% respectively (2016).

Keywords

Introduction

Poland and its sugar market represents very specific phenomenon among countries producing beet sugar. Polish sugar industry, as one of the few in the former Eastern bloc, survived very critical period. Despite significant reduction in the number of sugar factories from 76 (2001) to only 18 (2017), Polish sugar industry kept considerable production capacity. Current installed capacity of all sugar refineries can process approximately 114 thousand tonnes of sugar beet per one day. Refineries employ about 3,300 people. Annual sugar beet production reaches about 12.3 million tonnes and annual sugar

production approaches 2.3 million tonnes. Polish sugar industry produces about 1.3% of world sugar production and 12% of EU sugar. Polish share on global production of sugar from sugar beet oscillates around 5.6%. Local production exceeds local consumption of sugar by almost 600 thousand tonnes annually. Surplus in production creates appreciable export potential. Annually about 500 thousand tonnes of sugar is being exported, it represents a considerable share particularly on the European market or in the perspective of global trade with beet sugar. Polish market underwent significant restructuring that on one side resulted in significant reduction of number of sugar refineries and sugar beet producers. On the other hand, it resulted in considerable concentration of production capacities among subjects that successfully passed the transformation phase. Observed concentration is a general characteristic of the whole EU sugar industry (Benešová et al., 2015). Although many improvements were implemented by Polish sugar industry, still there are problems to be solved – for example logistics (Polowczyk and Baum, 2016) or observed slowdown in investments (Szajner, 2016).

In addition, it is important to mention, that during the transformation significant production capacities were acquired by foreign, predominantly German, capital. Foreign capital is represented by following companies: Südzucker; Nordzucker; Pfeifer&Langen. Position of the Polish state is also a specific feature of local sugar industry. The state still controls one of the largest sugar production corporations operating on Polish territory - Krajowa Spółka Cukrowa S.A.. Through this entity, state operates seven sugar refineries that produce about one-third of Polish sugar. Despite the general trends in Europe, the Polish market still has a relatively high degree of decentralization. Several large companies are operating on the market. They compete for market share, not only in relation to Poland's internal market but also in relation to the EU market. From this perspective, the Polish market is very different from the markets of most other EU countries. In this respect, a number of studies focusing on the issue of Polish sugar industry are worth noting (Artyszak, 2009; Bücherl 2004; 2005; 2006; 2008; Dobrowolski and Bücherl, 2007; 2009; Iwan 2005a; 2005b; Jagiełło, 2009; Molas et al., 2017; Trajer, 2013; Walkenhorst, 2001; Wawro, 2006; 2007; 2008; Wawro and Kuster 2004). These studies show a difficult process of transformation of Polish sugar industry, which had to respond not only to changes in the internal environment (transition from the centrally planned economy to the market

economy; restructuring of the economy in relation to the changing conditions in Poland's internal market) but also to changes of external conditions (restructuring of the global economy; accession to the European Union; adaptation to the conditions of the common Agricultural Policy; ongoing reforms of the sugar market in the EU single market). Abovementioned studies also concludes that Poland was able to transform this sector and adapt to new conditions. During transformation, Polish sugar industry became competitive and gained strong position within internal market of the EU, and it also strengthen in third countries like Israel, Georgia, Russia, Kazakhstan, etc. While Polish sugar is being exported in amount of about 280 thousand tones to EU countries (mainly Germany, Lithuania, Italy, Latvia, Greece and Hungary), still 220 thousand tons of sugar is mainly directed to abovementioned third countries.

Materials and methods

Main aim of presented contribution is to identify main trends and important specifics connected to Polish sugar industry development between 2000 and 2017. Own analyses is based on comparison of secondary data sourced from Polish national sources (National Research Institute, Agricultural Market Agency, Ministry of Agriculture and Rural Development, Central Statistical Office of Poland), Eurostat and F.O.Licht database.

For the purpose of own analyses, the following categories of data are observed: sugar beet yields, harvested area and total production; sugar production and trade (H4-1701); number and specifics of farms linked to beet production; number and specifics of sugar refineries; sugar consumption and its structure; sugar prices. Also, selected economic and financial indicators of individual actors are specified.

Individual data are analysed in usual metric units; prices are expressed in euros in nominal expression. The development over time is analysed by using simple statistical indicators such as average, median, geometric mean and base index (2017/2000).

The concentration of production capacities is analysed from the point of view of the most important Polish sugar industry players. This analysis is based on application of Herfindahl-Hirschmanov index (further referred as HHI) and "Four-firm concentration ratio" (further referred as CR4). HHI is able to measure the market concentration of the industry; therefore, it is used by competition authorities to secure

antitrust policy. HHI is characterized as the sum of the market shares of each trader in the sector and it is calculated as a sum of squared market share values of investigated entities in the industry:

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

where si stands for market share of corporation "i" in the sugar production, N denotes 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 0 indicates no concentration and high competitiveness of the market and 10 000 indicates low level of competition and signalise monopoly. In this contribution classification of concentration is based on methodology used by U. S. Department of Justice and Federal Trade Commission (2010). Their methodology indicates highly competitive environment for values below 100. Values below 1,500 indicates non-concentrated environment where operates number of important sugar companies. Values above 2,500 usually indicates market with monopolistic competition where exists significant concentration. The more HHI approaches 10,000, the more monopoly characteristics are evinced by the market.

The "Four-firm concentration ratio" (CR4) indicator is used to identify the main actors in the sugar market within the monitored group of countries. It assesses the share of the four largest companies operating in the sugar industry. This indicator is calculated as:

$$CR_n = \sum_{i=1}^{n} s_i = s_1 + s_2 + s_3 + \cdots + s_n \qquad (2)$$

For the CR4 evaluation, interpretation of DG Compete was used (London Economics, 2007). The values between 0 and 50% indicate perfect competition directing towards oligopoly. The range from 50 to 80% is a clear oligopoly and the results above 80% express the direction of the oligopoly towards the monopoly.

Attention is also paid to the competitiveness of Polish sugar industry and its ability to gain comparative advantage (measured by RCA, LFI and TBI index).

The Balassa index (or Revealed Comparative Advantage, RCA) tries to identify whether a country has a "revealed" comparative advantage rather than to determine the underlying sources of comparative advantage (Balassa, 1965; 1977; 1991). The index is calculated as follows:

$$RCA = (X_{ij} / X_{it}) / (X_{nj} / X_{nt}) = (X_{ij} / X_{nj}) / (X_{it} / X_{nt}) \qquad (3)$$

where x represents exports, i is a country, j is a commodity and n is a set of countries, t is a set of commodities.

The next index used in this paper is the Lafay index (Lafay, 1992). Using this index (LFI) we consider the difference between each item's normalized trade balance and the overall normalized trade balance. Using the LFI index we can focus on the bilateral trade relations between the countries and regions. For a given country(i) and for any given product (j), the Lafay index is defined as:

$$LFI^{i}_{j} = 100 \left(\frac{x^{i}_{j} - m^{i}_{j}}{x^{i}_{j} + m^{i}_{j}} - \frac{\sum_{j=1}^{N} (x^{i}_{j} - m^{i}_{j})}{\sum_{j=1}^{N} x^{i}_{j} + m^{i}_{j}} \right) \frac{x^{i}_{j} + m^{i}_{j}}{\sum_{l=1}^{N} x^{i}_{j} + m^{i}_{j}}$$

$$(4)$$

where xij and mij are exports and imports of product j of country i, towards and from the particular region or the rest of the world, respectively, and N is the number of items. Positive values of the Lafay index indicate the existence of comparative advantages in each item; the larger the value the higher the degree of specialisation. (Zaghini, 2003)

Finally, Trade Balance Index (TBI) is employed to analyse whether a country has specialization in export (as net-exporter) or in import (as net-importer) for a specific group of products. TBI is simply formulated as follows:

$$TBI_{ij} = (x_{ij} - m_{ij}) / (x_{ij} + m_{ij}) \qquad (5)$$

where TBI_{ij} denotes trade balance index of country i for product j; x_{ij} and m_{ij} represent exports and imports of group of products j by country i, respectively (Lafay, 1992). A country is referred to as a "net-importer" in a specific group of products if the value of TBI is negative, and as a "net-exporter" if the value of TBI is positive (Widodo, 2009).

Results and discussion

Polish sugar market developed in a very specific way during last 17 years. Significant changes influenced not only sugar-producing entities, but also agricultural producers who supply a key input for sugar production in Poland – sugar beet. Between 2000 and 2017, the situation in the sugar beet production sector changed significantly. While in 2000 sugar beet was harvested from 318 ths. hectares, between 2015 and 2017 beet was harvested only from 202 ths. hectares. Although the area shrank by about 34%, total sugar beet

production was not limited. Annual production oscillated around 10 and 12 million tonnes. Decrease of harvested area was compensated by improving situation in yield (as also described by Řezbová et al., 2013); between 2000 and 2017 yield increased by 60% from 40 t/ha up to more than 60t/ha. Also, number of farmers changed. While in 2000 about 112 ths. farms were producing sugar beet, in 2017 only 34 ths. farms continued with sugar beet production.

There was observed increase in the average number of farms supplying one refinery. In 2000, about 1,500 sugar beet producers supplied one refinery, while in 2017 this value already exceeded 1,900 farms. Also, average harvested area per one farm increased. While in 2000 average farm harvested beet from 3ha, in 2017 average area approached 6.5 ha. Significance of this change was also confirmed by research conducted on the level of the EU (Eurostat, 2017) as it concluded that share of small scale farers (up to 5 hectares) on sugar beet production was reduced from 90 to 7.3%. As small farms produced almost 50% of total sugar beet in 2000, in 2013

their share was only 1.2%. At present, nearly 50% of beet growing areas are under the control of farms with a size exceeding 50 hectares, growing sugar beet on more than fifty hectares. As a result, significant restructuring of sugar beet production was observed, this resulted in a reduction in the number of growers and greater concentration of production capacities. Undoubtedly, this trend has also been accompanied by a significantly higher efficiency of beet production, which subsequently allowed a significant increase in yield. Over the period, sugar beet price oscillated between 25 and 40 EUR per tonne, however in terms of the long-term average, price ranged between 25 and 30 EUR/tonne.

Also from the European point of view, it needs to be mentioned, that some national coupled payments are still provided for sensitive commodities. Based on information from Table 2 it needs to be stressed out, that in comparison with for example the Czech Republic and Italy, the support in Poland is higher by more than 100 EUR per hectare. Also, when other aspects of Polish sugar beet production are compared to other EU

Sugar beet production	2000-2002	2003-2005	2006-2008	2009-2011	2012-2014	2015-2017	GEOMEAN	Basic index 2017/2000
Area (thous. ha)	318	290	232	203	201	202	0.97	0.661
Yield (t/ha)	39.8	41.8	47.2	53.3	61.5	60.2	1.032	1.599
Production (thous. tonnes)	12 643	12 127	10 957	10 832	12 358	12 255	1.002	1.058

Source: Sugar market - the state and prospects, No. 20-44, Institute of Agricultural and Food Economics - National Research Institute, Agricultural Market Agency, Ministry of Agriculture and Rural Development, Warsaw 2001-2017

Table 1: Sugar beet production development.

EUR	Finland	Croatia	CZ	Italy	Greece	Poland	Slovakia	Hungary	Rumania
	67	121	267	276	311	384	390	396	600

Source: Ministry of Agriculture of the Czech Republic (2017)

Table 2: National additional coupled payments – calculated per hectare.

Average[1,2]	Area (thous. Ha)[1]	Yield (100 kg)[1]	Production (thous. tonnes)[1]	Cultivated area per one grower[2]
France	421.06	874.98	36 901.89	13.86
Germany	351.33	741.93	24 034.60	10.70
Poland	**202.16**	**604.83**	**12 309.43**	**5.30**
United Kingdom	95.67	720.99	6 968.33	28.22
Netherlands	71.50	832.62	5 979.35	4.51
Belgium	56.77	787.60	4 238.61	7.69
Czech Republic	61.48	630.50	3 878.40	77.40
Spain	35.66	932.88	3 329.82	5.43
Italy	36.18	603.21	2 115.09	5.09
Austria	43.91	707.99	3 104.19	6.84

Note: [1] 2015-2017 average; [2] 2014-2016 average
Source: Eurostat, 2017, CEFS Sugar Statistics 2016

Table 3: Production in selected EU countries.

countries (Table 3), it can be understood, that although Poland evince third largest sugar beer production in the whole EU and cultivate third largest area, Polish producers belongs among the smallest suppliers of sugar beet. Average cultivated area of one Polish sugar beet grower is equal to 5.3 ha in 3 year average. In comparison to largest producers (France and Germany), the average area is less than half. On contrary, among the top 10 EU producers, the largest average area is reached by the by Czech (77.4 ha) and UK (28.2) farmers.

Stable production of sugar beet logically resulted also in relatively stable production of sugar (table 7). Between 2000 and 2017, total sugar production oscillated close to 2 million tonnes of raw sugar equivalent. Sugar production was also

significantly increased in relation to one harvested hectare. Original value of year 2000 (production of 6.56 tonnes of sugar per one hectare) almost doubled (to 11.2 tonnes per hectare). Observing values in table 7 it can be concluded, that production of raw sugar equivalent grew year-on-year by approximately 1% and sugar production per hectare has been increasing on average by 3.4% per year.

Years	Number of farms		Cultivated area	
	In total	Per 1 operating sugar enterprise	In total	Per 1 farm
	thous.		thous. ha	ha
2000	111.9	1.5	333	2.98
2002	91.5	1.4	303	3.31
2004	77.9	1.8	297	3.81
2006	63.2	2.0	262	4.15
2008	40.9	2.2	187	4.57
2010	38.2	2.1	206	5.39
2012	35.8	2.0	212	5.92
2014	35.0	1.9	198	5.66
2016	34.0	1.9	206	6.06
2017	34.0	1.9	220	6.47
Growth rate /GEOMEAN	0.932	1.014	0.976	1.047
BASIC INDEX 2017/2000	0.304	1.267	0.661	2.171

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017.

Table 3: Production in selected EU countries.

Countries	Number of farms						Cultivated area							
	Total no.	0-5 ha		5-50 ha		over 50 ha		In total	0-5 ha		5-50 ha		over 50 ha	
	(thous.)	thous.	%	thous.	%	thous.	%	thous. ha	thous. ha	%	thous. ha	%	thous. ha	%
2003														
Poland	101.3	91.1	89.9	9.6	9.5	0.6	0.6	303	150.7	49.7	86.1	28.4	66.2	21.8
2013														
Poland	41.1	3	7.3	33.2	80.8	4.9	11.9	193.7	2.4	1.2	100	51.6	91.3	47.1

Source: Eurostat database.

Table 5: Structure of sugar beet producers.

EUR/tonne	2000	2002	2004	2006	2008	2010	2012	2014	2015	2016	GEO-MEAN	Basic 2000/2017
Poland	25.41	29.05	41.31	33.05	29.51	28.31	32.78	30.1	28.56	26.72	1.003	1.052

Source: Eurostat database.

Table 6: Sugar beet prices.

Sugar production	Poland	
(raw sugar equivalent)	thous. tonnes	tonnes per ha
2000/2001	2.013	6.56
2002/2003	2.193	7.24
2004/2005	2.176	7.45
2006/2007	1.873	7.94
2008/2009	1.411	8.02
2010/2011	1.556	7.33
2012/2013	2.025	9.82
2014/2015	2.156	11.2
2016/2017	2.283	11.2
Growth rate /GEOMEAN	1.008	1.034
BASIC INDEX 2017/2000	1.134	1.707

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017.

Table 7: Development of raw sugar production.

A number of companies operating on the market (see Table 8 and 9) and the development of the number of sugar refineries are another specific feature of the Polish sugar industry. Between 2001 and 2017, the number of sugar refineries was reduced by more than 70%. Most of the sugar refineries was closed by Krajowa Spółka Cukrowa S.A (20 refineries); Śląska Spółka Cukrowa (16 refineries); Sŭdzucker S.A. (12 refineries) and British Sugar Overseas - Poland (10 refineries). Śląska Spółka Cukrowa and British Sugar Overseas closed all their sugar production activities and since then they are not active on the market. Pfeiffer&Langen closed 7 and Nordzucker S.A. closed 6 sugar refineries. It is important to mention that the reduction in the number of sugar refineries has not been reflected significantly in sugar production. Despite the decreasing number of sugar refineries (-58), the volume of sugar production has not been significantly affected. Even the production loss caused by closure of two groups was completely compensated. Producers who remained on the market increased production. In particular, Südzucker S.A. increased sugar production capacity from 105 ths. to 523 ths. tonnes; Pfeiffer&Langen increased production from 273 ths. to 550 ths. tonnes. Also, campaign length was extended, and it resulted in improved efficiency. In average, Polish sugar campaign prolonged from 51 (2001) to 112 days (2016); Krajowa Spółka Cukrowa S.A increased the average number of campaign days from 51 to 102; Sŭdzucker S.A. from 40 to 127 days; Pfeiffer&Langen from 51 to 120 days and Nordzucker S.A. from 55 to 103 days.

Speaking about sugar-producing groups, it is worth mentioning, that mainly Sŭdzucker and Pfeiffer&Langen required more sugar beet due to longer campaign increased production. Therefore, they increased their share on purchased beet measured by share on contracted beet production area. Their share rose from 8.3 to 22.4% and 15.6 to 26.3% respectively (table 8). In the case of other producers, their shares on the contracted production areas remained preserved. On the other hand, all companies evince significant reduction in the number of contracted farms. But this reduction was fully compensated by the fact, that an average contracted farm intensified its production.

Specification	Cultivated area		Number of farms	Average area of 1 farm	Yield
	thous. ha	%	(thousands)	(ha)	(t/ha)
2001/2002					
Krajowa Spółka Cukrowa S.A.	122.3	40.7	46.5	2.6	na
Śląska Spółka Cukrowa	46.6	15.5	10	4.6	na
Sŭdzucker S.A.	25	8.3	11.8	2.1	na
Pfeiffer&Langen	46.9	15.6	12.2	3.9	na
British Sugar Overseas - Polska	34.8	11.6	12.4	2.8	na
Nordzucker S.A.	25.2	8.4	6.5	3.9	na
Poland	**300.8**	**100**	**99.4**	**3**	**na**
2003/2004					
Krajowa Spółka Cukrowa S.A.	130.1	42.6	42.5	3.1	na
Sŭdzucker S.A.	72.7	23.8	17.8	4.1	na
Pfeiffer&Langen	45.5	14.9	10.8	4.2	na
British Sugar Overseas - Polska	33.4	10.9	8.9	3.8	na
Nordzucker S.A.	23.7	7.8	5.9	4	na
Poland	**305.4**	**100**	**85.9**	**3.6**	**na**

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017; Świetlicki (2015, 2016, 2017)

Table 8: The most important sugar producers in Poland and their sugar beet capacity (to be continued).

Specification	Cultivated area		Number of farms	Average area of 1 farm	Yield
	thous. ha	%	(thousands)	(ha)	(t/ha)
2005/2006					
Krajowa Spółka Cukrowa S.A.	110.9	40.5	33.4	3.3	na
Sűdzucker S.A.	67.3	24.6	14.8	4.6	na
Pfeiffer&Langen	43.2	15.8	9.9	4.4	na
British Sugar Overseas - Polska	29.9	10.9	7.1	4.2	na
Nordzucker S.A.	22.6	8.3	5.5	4.1	na
Poland	**273.9**	**100**	**70.7**	**3.9**	**na**
2009/2010					
Krajowa Spółka Cukrowa S.A.	75.2	39.4	18.2	4.1	54.9
Sűdzucker S.A.	43.8	22.9	8.1	5.4	59.4
Pfeiffer&Langen	32.2	16.9	6.1	5.3	58.9
British Sugar Overseas	21.8	11.4	4.3	5	51.7
Nordzucker S.A.	18	9.4	3.3	5.5	60.4
Poland	**191**	**100**	**40**	**4.8**	**56.7**
2011/2012					
Krajowa Spółka Cukrowa S.A.	77	40.5	16.3	4.9	57.9
Sűdzucker S.A.	43	22.6	6.8	6.6	69.1
Pfeiffer&Langen	51	26.8	9.6	5.5	58.4
Nordzucker S.A.	19	10	3.2	6.1	66.4
Poland	**190**	**100**	**35.9**	**5.3**	**61.1**
2013/2014					
Krajowa Spółka Cukrowa S.A.	76	41.2	16.2	4.7	59.7
Sűdzucker S.A.	51.4	27.8	9.6	5.3	57.1
Pfeiffer&Langen	38.7	21	6.8	5.7	64.5
Nordzucker S.A.	18.5	10	3.1	6	66.8
Poland	**184.6**	**100**	**35.7**	**5.2**	**60.8**
2016/2017					
Krajowa Spółka Cukrowa S.A.	83.6	41.2	15.2	5.5	65.8
Sűdzucker S.A.	45.4	22.4	6.4	7.1	68.6
Pfeiffer&Langen	53.4	26.3	9.4	5.7	63.5
Nordzucker S.A.	20.7	10.2	3.1	6.7	72.5
Poland	**203.1**	**100**	**34.1**	**6**	**66.5**

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017; Świetlicki (2015, 2016, 2017)

Table 8: The most important sugar producers in Poland and their sugar beet capacit (continuation).

Specification	2001	2003	2005	2007	2009	2011	2013	2015	2016
Number of enterprises									
Krajowa Spółka Cukrowa S.A.	27	24	18	11	7	7	7	7	7
Śląska Spółka Cukrowa	16	x	x	x	x	x	x	x	x
Sűdzucker S.A.	6	17	11	10	5	5	5	5	5
Pfeiffer&Langen	11	5	4	4	4	4	4	4	4
British Sugar Overseas	10	3	2	2	x	x	x	x	x
Nordzucker S.A.	6	8	5	2	2	2	2	2	2
Total	76	57	40	29	18	18	18	18	18

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017; Świetlicki (2015, 2016, 2017).

Table 9: The most important sugar producers - selected characteristics (to be continued).

Specification	2001	2003	2005	2007	2009	2011	2013	2015	2016
Number of enterprises									
Production of white sugar (thous. tonnes)									
Krajowa Spółka Cukrowa S.A.	629	797	795	722	608	694	na	na	815
Śląska Spółka Cukrowa	244	x	x	x	x	x	x	x	x
Sűdzucker S.A.	105	488	537	462	375	468	na	na	523
Pfeiffer&Langen	273	220	208	337	286	500	na	na	550
British Sugar Overseas	153	280	177	227	x	x	x	x	x
Nordzucker S.A.	137	161	351	185	169	197	na	na	196
Total	1 540	1 946	2 068	1 934	1 437	1 859	1 713	1 464	2 084
Time of sugar beet processing (days)									
Krajowa Spółka Cukrowa S.A.	51	60	65	83	103	97	91	71	102
Śląska Spółka Cukrowa	48	x	x	x	x	x	x	x	x
Sűdzucker S.A.	40	66	96	92	114	126	101	130	127
Pfeiffer&Langen	51	87	92	124	140	114	107	95	120
British Sugar Overseas	66	57	90	99	x	x	x	x	x
Nordzucker S.A.	55	72	101	94	88	97	99	82	103
Total	51	62	84	93	107	107	98	81	112

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017; Świetlicki (2015, 2016, 2017).

Table 9: The most important sugar producers - selected characteristics (continuation).

Installed daily capacity for sugar beet processing among individual refineries is another characteristic feature of Polish sugar industry. An overview of these capacities, together with a detailed list of active sugar refineries, can be found in table 10. Based on the available data it can be concluded that Polish sugar refineries can be considered relatively large. Their daily beet processing capacity ranges from 3,500 to 12,200 tonnes, average capacity per one sugar refinery reaches about 6,351 tonnes per day. With only two exceptions, all refineries produce sugar from sugar beet; only refineries in Glinojeck and Chelmza have limited capacity (1,200 t/day and 800 t/day respectively) to process also imported raw sugar. During the transformation period, average annual sugar production capacity was increased significantly. Between 2001 and 2006, average production of each refinery increased from 20 ths. to 116 ths. tonnes per annum. An important indicator is also the increase of annual average sales per one sugar refinery. In 2016, average refinery evinced sales of about 70 million EUR. Total turnover of all Polish refineries was about 1.153 billion EUR. Labour productivity development was also observed; in 2016 sugar production per one employee reached approximately 630 tonnes. Turnover per employed person was about 380 ths. EUR per person employed (see table 11). Also, economic indicators of the whole sugar industry improved (table 12). Indicators changed as follow between 2000 and 2016: total revenues

(+17%), net income (+198%), return on sales (from 6.7 to 17%), liquidity (from 1.1 to 4.0). Also a continuous transfer of investments was reflected in the Polish sugar industry, as cumulated investments reached a total of 4.115 billion PLN (1.016 billion EUR) between 2000 and 2016. Similarly to Szajner (2016), it can be concluded that investments are being slowed down. Investment peak is observed in 2006 (93.6 million EUR), since than investments have been falling to 49.4 million EUR in 2016.

The economic performance of the sector was largely reflected in relatively stable sugar market. The average price, with some exceptions, fluctuated between 0.5 and 0.6 EUR/kg. Polish market was also stabilised by slowly increasing consumption as it rose from 1.6 to 1.72 million tonnes. Increase in consumption was not pushed by change in consumption among Polish households, but it was pushed by food industry. While consumption of households decreased from 780 to 550 ths. tonnes between 2000 and 2017 (-30%), consumption of food industry increased from 770 ths. to 1.1 million tonnes (+42%). Decreasing consumption of Polish households was fully compensated by the growing consumption of food industry, which increased consumption by more than 300,000 tons a year. Per capita sugar consumption remained relatively stable throughout the monitored period. It remained at a level exceeding 40 kg per year (Table 14).

It is necessary to mention, considering sugar production and installed production capacities, that Polish market evince relatively high concentration rate. According to the HH index (2,944 points), Polish sugar market operates under monopolistic competition with significant concentration.

CR4 index (100%) indicates that market directs from oligopoly towards the monopoly. Polish sugar market evinces oligopolistic character. The distribution of installed production capacities also shows the high degree of market concentration (HH Index even reaches 3,070).

Owner/Operator	Location	Region	Production Capacity	Feedstocks
Krajowa Spolka Cukrowa S.A.	Dobrzelin	Lodz	2012:4,290 t/day	Sugar beet
Krajowa Spolka Cukrowa S.A.	Kluczewo	Greater Poland	2012:7,989 t/day	Sugar beet
Krajowa Spolka Cukrowa S.A.	Krasnystaw	Lublin	2012:9,457 t/day	Sugar beet
Krajowa Spolka Cukrowa S.A.	Kruszwica	Kuyavian-Pomeranian	2012:8,644 t/day	Sugar beet
Krajowa Spolka Cukrowa S.A.	Malbork	Pomeranian	2012:5,754 t/day	Sugar beet
Krajowa Spolka Cukrowa S.A.	Naklo	Kuyavian-Pomeranian	2012:4,809 t/day	Sugar beet
Krajowa Spolka Cukrowa S.A.	Werbkowice	Lublin	2012:7,516 t/day	Sugar beet
Nordzucker Polska S.A.	Chelmza	Kuyavian-Pomeranian	2012:6,511 t/day DRC:2008:800 t/day	Sugar beet. raw sugar
Nordzucker Polska S.A.	Opalenica	Kuyavian-Pomeranian	2012:6,116 t/day	Sugar beet
Pfeifer&Langen	Glinojeck	Mazovia	2014:12,200 t/day DRC: 2009:1,200 t/day	Sugar beet. raw sugar
Pfeifer&Langen	Gosty	Greater Poland	2012:5,274 t/day	Sugar beet
Pfeifer&Langen	Miejska Górka	Greater Poland	2012:4,251 t/day	Sugar beet
Pfeifer&Langen	?roda	Greater Poland	2012:5,808 t/day	Sugar beet
Südzucker Polska S.A.	Cerekiew	Opole	2016:5,600 t/day	Sugar beet
Südzucker Polska S.A.	Ropczyce	Subcarpathia	2016:6,100 t/day	Sugar beet
Südzucker Polska S.A.	Strzelin	Lower Silesia	2016:5,900 t/day	Sugar beet
Südzucker Polska S.A.	Strzyzow	Subcarpathia	2012:3,500 t/day	Sugar beet
Südzucker Polska S.A.	Swidnica	Silesia	2016:4,600 t/day	Sugar beet

Source: F.O.Licht. 2017

Table 10: Sugar refineries and their processing capacities (tonnes per day).

Specification	2001	2003	2005	2007	2009	2011	2013	2015	2016
Sales. in total (million EUR)	na	na	na	1 155	1 039	1 540	1 477	1 031	1 253
Sales. per 1 enterprise (million EUR)	na	na	na	40	58	86	82	57	70
Labour productivity (tonnes per emplyee)	na	na	na	263	342	531	518	444	630
Labour productivity (thous. EUR per employee)	na	na	na	157	221	440	434	312	380

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017.

Table 11: Selected Economic Characteristics of Polish Sugar Industry - Part I.

Specification	2000	2002	2004	2006	2008	2010	2012	2014	2016	BASIC
Net revenue. current prices (million EUR)	1 101.40	1 217.60	1 396.30	1 356.10	1 175.10	1 148.20	1 820.20	1 255.00	1 290.30	1.17
Net profit (million EUR)	73.4	-5.2	149.3	108.8	-88.1	164.2	398.3	134.3	218.9	2.98
Return on sales (%)	6.7	-0.4	10.7	8	-7.5	14.3	21.9	10.7	17	2.55
Current liquidity ratio	1.1	1.1	1.4	1.7	2.6	3.3	3.4	3.3	4	3.77
Investment. current prices (million EUR)	23.5	34	55.4	93.6	87.5	72.4	69.4	52.5	49.4	2.11

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017.

Table 12: Selected Economic Characteristics of Polish Sugar Industry - Part II.

Year	PLN per 1 kg	EUR per 1 kg
2000	2.36	0.59
2002	2.10	0.54
2004	2.62	0.58
2006	2.64	0.68
2008	2.19	0.62
2010	2.15	0.54
2012	3.25	0.78
2014	2.08	0.50
2016	2.37	0.54
Growth rate /GEOMEAN	1.0003	0.9950
BASIC INDEX 2017/2000	1.0042	0.9225

Source: Central Statictical Office of Poland. Local Data Bank. https://bdl.stat.gov.pl/BDL/start#. 21.08.2017

Table 13: Development of white beet sugar price in Poland (in sacks).

Year	Sugar consumption (thous. tonnes)				Sugar consumption per capita (kg)
	households	food industry	other uses	in total	
2000	780	770	45	1 595	41.6
2002	755	790	45	1 590	43.6
2004	740	830	45	1 615	37.6
2006	730	845	45	1 620	35.2
2008	715	855	50	1 620	38.4
2010	660	850	60	1 570	39.9
2012	600	950	60	1 610	42.5
2014	610	1 025	65	1 700	44.3
2016	545	1 075	70	1 690	41.5
2017	550	1 095	75	1 720	42.5
Growth rate / GEOMEAN	0.9797	1.0209	1.0305	1.0044	1.0013
BASIC INDEX 2017/2000	0.7051	1.4221	1.6667	1.0784	1.0216

Source: Sugar market - the state and prospects. No. 44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development

Table 14: Development and structure of Polish sugar consumption.

Polish sugar industry is strongly influenced by international trade. Between 2000 and 2017, the volume of sugar exports oscillated between 350 and 700 thousand tonnes. The peak (702 ths. tonnes) was reached in 2006, the minimum (335 ths. tonnes) was realized in 2011. In average, total annual exports amounted to 430 ths. tonnes and increased in average by 0.9% per annum. Polish exports can be characterized by relatively significant year-on-year fluctuations. Its standard deviation from the average was about 30%. On contrary to volumes, value of exports evinced annual growth of about 5.3% as the value increased from approx. 100 million to 240 million EUR.

Lowest value of exports is observed in 2002 (51 million EUR), while maximum (377 mil. EUR) occurred in 2012. Also export values were highly volatile. This statement is supported by the standard deviation of mean that reached 45%. The value and volume of exports was influenced by the development of unit prices as they increased from 0.23 in 2002 to 0.48 EUR/Kg in 2017, instability of export price is supported by standard deviation of mean at the level of 33%.

Value and volume of imports rose more dynamically compared to exports. Between 2000 and 2017, volume of imports increased from 55 to 210 ths. tonnes; value of imports rose from 16 to 90 million EUR. While value and volume of exports gained in average 5.3%, respectively 0.9% per annum, import values and volumes gained in average 8.2% and 10.8% (table 15). However, it must be noted, that import was even more unstable than exports; standard deviation from mean are 59% (for volumes) and 69% (for values). Although the growth rate of imports outperformed the of exports (with only exception of kilogram price: 4.3% per annum for export vs. 2.4% for import), Poland managed to maintain a positive trade balance in the analysed period, both in value and volume terms. At present (2016/2017), the surplus of the trade balance is estimated to be about 150 million EUR and 290 ths. tonnes of sugar.

A particular feature of the Polish sugar market is its trade orientation primarily to the EU countries. Poland export significant share of its production in the EU. However, the EU market has not always been a key sugar destination. In the pre-accession period, particularly in year 2000, Poland only exported 1.85% of its exported volumes (i.e. around 2.51% of exported value) to the EU. Subsequently, as the accession was approaching, share of Polish exports to the EU increased. In 2003, EU received about 24.98% and 26.09% of exported volume and value respectively. Entry into the EU was a turning point from the perspectives of Polish agrarian foreign trade. In 2004, as much as 48.56% and 73.53% of Polish export directed to the EU countries measured in volume and value. This situation was affected by change in export price, related to higher price of sugar in the EU. The export price, after Poland became EU member and accessed the single market, grew from an average 0.21 to 0.57 EUR/kg between 2003 and 2004. Exports to the EU single market grew from 100 ths. tonnes (23 million EUR) in the period immediately before the accession

Total trade	Export			Import			Trade balance	
	ths. tonnes	million EUR	EUR/kg	ths. tonnes	million EUR	EUR/kg	ths. tonnes	million EUR
2000	427.9	99.7	0.23	55.2	15.7	0.28	372.7	84.0
2001	295.1	91.1	0.31	64.0	20.4	0.32	231.1	70.7
2002	207.8	51.0	0.25	86.1	28.1	0.33	121.8	22.9
2003	425.6	87.0	0.20	75.1	19.1	0.25	350.5	67.9
2004	428.3	161.3	0.38	44.2	20.3	0.46	384.1	141.0
2005	657.7	184.4	0.28	48.0	26.2	0.55	609.7	158.2
2006	702.6	225.6	0.32	70.6	45.9	0.65	632.0	179.7
2007	348.4	139.5	0.40	49.5	30.4	0.61	298.9	109.1
2008	403.7	164.2	0.41	125.3	68.1	0.54	278.4	96.1
2009	188.2	101.8	0.54	244.8	126.3	0.52	-56.6	-24.5
2010	380.8	186.4	0.49	200.9	93.4	0.46	179.9	93.0
2011	335.3	230.4	0.69	288.0	163.8	0.57	47.3	66.6
2012	576.1	377.2	0.65	252.1	154.4	0.61	324.0	222.8
2013	507.9	307.2	0.60	197.0	117.5	0.60	310.9	189.7
2014	467.8	219.3	0.47	209.4	112.2	0.54	258.4	107.1
2015	432.0	186.9	0.43	118.5	54.6	0.46	313.5	132.3
2016	464.9	225.7	0.49	229.7	106.3	0.46	235.2	119.4
2017	500.0	240.0	0.48	210.0	90.0	0.43	290.0	150.0
Growth rate / GEOMEAN	1.009	1.053	1.043	1.082	1.108	1.024	N/A	N/A
BASIC INDEX 2017/2000	1.168	2.407	2.060	3.804	5.733	1.507	0.778	1.785

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017

Table 15: Development of foreign trade in sugar.

to less than 300 ths. tonnes (150 million EUR) in 2016. The export maximum was reached in 2013, when the total volume of exports amounted to approximately 365 ths. tonnes (about 250 million EUR). The share of EU countries in sugar exports reached its peak in 2009, when about 88.52% (in volume terms) and 91.94% (in value terms) of exports directed to single market. After 2013, export to EU evinced further decrease. In 2016, 61.37 percent of trade volume finished in EU (66.37 of trade value). Above stated information indicates, that between 2004 and 2016 the exports to the EU underwent turbulent changes and fluctuations, as volume and kilogram export prices strongly oscillated. The average year-on-year change can serve as an evidence of this turbulent development, it achieved in value and volume terms 30.8 and 27.6 percent respectively. High fluctuation can be also indicated by a high percentage rate of standard deviation from the mean reaching 57.52% and 65.92% percent in volume and value respectively. Unit export price showed in average standard deviation from the mean of about 28.13 percent.

Among relatively volatile exports, similar market behaviour can be observed in relation to imports. Import volumes and values evince relatively high average annual rate of change. Through the observed period, annual average rate of change reached in value and volume 9.4 and 12.3 percent respectively. Observed export growth rate outperformed import growth rate (see Table 15). On the other hand, import deviations were much more intensive than export annual deviations as it could be observed in the values of average standard deviation from mean of sugar import volumes (64.13%) and values (78.16%). Even growth rate of kilogram import prices (2.6% per annum) grew little bit faster than export prices (2.5% per annum). Import prices has higher standard deviation from the mean (37.70%), comparing to export price (28.13%). Generally, volumes of imports from EU countries fluctuated over time. At the beginning of the analysed period, the share of imports from the EU countries was very significant, both in the case of import volumes (about 45 ths. tonnes, share 82.7%) as well as in the case of import values (12.5 million EUR, share 79.6%). Prior to the EU accession (2003), imports amounted to 74 ths. tonnes, respectively it amounted to less than 20 million EUR and the share of imports from EU countries accounted for 96.86% and 98.93% respectively. In the period after the accession, share of EU countries on Polish sugar

Total trade	Export			Import			Trade balance	
	ths. tonnes	million EUR	EUR/kg	ths. tonnes	million EUR	EUR/kg	ths. tonnes	million EUR
2000	7.9	2.5	0.32	45.3	12.5	0.27	-37.4	-10.0
2001	4.5	2.0	0.45	41.4	13.6	0.33	-36.9	-11.6
2002	45.5	12.3	0.27	75.9	24.7	0.33	-30.4	-12.4
2003	106.3	22.7	0.21	74.3	18.5	0.25	32.0	4.2
2004	208.0	118.6	0.57	41.1	19.3	0.47	166.9	99.3
2005	112.0	69.1	0.62	33.2	19.7	0.59	78.8	49.4
2006	79.5	50.8	0.64	53.0	35.5	0.67	26.5	15.3
2007	182.9	99.0	0.54	34.9	22.5	0.64	148.0	76.5
2008	248.3	124.6	0.50	82.1	46.5	0.57	166.2	78.1
2009	166.6	93.6	0.56	223.4	115.8	0.52	-56.8	-22.2
2010	231.5	118.6	0.51	182.9	72.3	0.40	48.6	46.3
2011	258.7	185.7	0.72	124.0	136.9	1.10	134.7	48.8
2012	209.2	160.5	0.77	45.7	36.4	0.80	163.5	124.1
2013	365.1	250.5	0.69	59.6	39.9	0.67	305.5	210.6
2014	318.7	169.0	0.53	92.1	49.3	0.54	226.6	119.7
2015	277.5	129.0	0.46	60.6	29.7	0.49	216.9	99.3
2016	285.3	149.8	0.53	86.0	44.8	0.52	199.3	105.0
2017	1.276	1.308	1.025	1.094	1.123	1.026	N/A	N/A
Growth rate / GEOMEAN	63.291	96.376	1.523	4.636	7.228	1.559	-7.754	-15.059
BASIC INDEX 2017/2000	1.168	2.407	2.060	3.804	5.733	1.507	0.778	1.785

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute. Agricultural Market Agency. Ministry of Agriculture and Rural Development. Warsaw 2001-2017.

Table 16: Polish foreign trade in sugar within the EU internal market.

imports was gradually reduced. A minimum was reached in 2012, when EU accounted only for 18.13% of imported volume and 23.58% of imported value. Imports from the EU reached its maximum in terms of volumes in 2009 (223 ths. tonnes) and in terms of value in 2011 (137 million EUR) (Table 16). EU sugar market regulations supported import fluctuations, as they significantly affected Polish production capacities as well as capacities in other countries. In addition, the Common Commercial Policy and Common Agriculture Policy influenced performance of agrarian foreign trade, as both policies isolated the EU internal sugar market from the rest of the world. The sugar price and supplied quantity were not determined by demand, but their development was largely determined by subsidies, production and import regulations. Present Polish sugar market is characterised by positive trade balance expressed both in trade volume and value. Negative trade balance was only observed prior to Polish EU accession and in year 2009. Internationalization of its production capacities was very important aspect that has significantly influenced the character of Polish foreign trade. Majority of production is no longer under the control of primarily Polish capital,

but they are under the control of international capital. A significant part of Polish production and export capacities are controlled mainly by German companies such as Nordzucker, Südzucker and Pfeifer&Langen. Polish sugar industry was significantly affected by applied sugar production quotas (Table 17). For a long time, they limited production at the level of 1.4 million tonnes of sugar a year. On one hand, quotas greatly reduced the export ambitions of Polish sugar industry; however, on the other hand quota system generally protected the Polish market from competition from other EU countries.

2004/2005	1,580.0 (A); 91.9 (B)
	91.9 (B)
2005/2006	1,495.3 (A)
	87.0 (B)
2006/2007	1,671.9
2007/2008	1,772.5
2008/2009 – 2015/2016	1,405.6

Source: Sugar market - the state and prospects. No. 20-44. Institute of Agricultural and Food Economics - National Research Institute, Agricultural Market Agency, Ministry of Agriculture and Rural Development. Warsaw 2001-2017.

Table 17: Development of sugar production quotas (in ths. tonnes).

The territorial structure of the Polish sugar trade is very concentrated. The top five export destinations (Germany, Israel, Lithuania, Italy and Latvia) accounted for approximately 52.6 percent of Polish sugar exports in value. Russian Federation, Czechia, Georgia, Greece and Hungary belong together with above mentioned countries, to the TOP10 export partners. The share of TOP10 trading partners in total sugar exports reached approximately 72.56% in 2016. An even higher degree of concentration is observed by the territorial structure of Polish imports. TOP5 (Sudan, Zimbabwe, Mozambique, Germany, Lithuania) and TOP10 (TOP5+Sweden, Mauritius, Czechia, Denmark, Ukraine) import destinations accounted for 71.4 and 92.94 percent of sugar imports to Poland. More details about the territorial concentration of the Polish sugar trade are shown in tables 18 and 19. The HH Index analysis shows the high level of concentration of the territorial structure of the sugar foreign trade, both from the export and import perspective. The HHI value for the export reaches 965 points and the HHI value of imports reaches about 1228 points. Also, CR4 confirms high level of territorial concentration, as CR4 export and import analyses evince value of 47.2 and 62.5 percent respectively.

Existing comparative advantage in relation to partner countries is another specific feature of Polish sugar industry. Table 20 provides an overview of the comparative advantage at the level of individual trading partners/countries. These data show that Poland has carried foreign trade transaction with about ninety countries in 2016. It can be concluded, based on the results of the LFI analyses, that Poland achieved bilateral comparative advantage of its exports with about 50 countries. From more general perspective (RCA analyses), Polish exports were able to achieve trade advantage with about 30 countries. Poland also achieved positive trade balance

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value	Share
2016	Export	Poland	World	H4-1701	247 348 280	100.00%
2016	Export	Poland	Germany	H4-1701	63 492 160	25.67%
2016	Export	Poland	Israel	H4-1701	22 031 586	8.91%
2016	Export	Poland	Lithuania	H4-1701	16 744 527	6.77%
2016	Export	Poland	Italy	H4-1701	14 510 120	5.87%
2016	Export	Poland	Latvia	H4-1701	13 329 238	5.39%
TOP5					130 107 631	52.60%
2016	Export	Poland	Russian Federation	H4-1701	10 109 310	4.09%
2016	Export	Poland	Czechia	H4-1701	11 152 137	4.51%
2016	Export	Poland	Georgia	H4-1701	8 269 608	3.34%
2016	Export	Poland	Greece	H4-1701	8 659 708	3.50%
2016	Export	Poland	Hungary	H4-1701	11 178 580	4.52%
TOP10					179 476 974	72.56%
2016	Export	Poland	Kazakhstan	H4-1701	5 698 003	2.30%
2016	Export	Poland	Sri Lanka	H4-1701	5 471 887	2.21%
2016	Export	Poland	Sudan	H4-1701	4 847 230	1.96%
2016	Export	Poland	Belgium	H4-1701	5 327 845	2.15%
2016	Export	Poland	Lebanon	H4-1701	4 347 579	1.76%
TOP15					205 169 518	82.95%
2016	Export	Poland	United Arab Emirates	H4-1701	3 649 026	1.48%
2016	Export	Poland	Rep. of Moldova	H4-1701	2 953 972	1.19%
2016	Export	Poland	Slovakia	H4-1701	3 442 443	1.39%
2016	Export	Poland	Algeria	H4-1701	2 619 704	1.06%
2016	Export	Poland	Egypt	H4-1701	2 310 116	0.93%
2016	Export	Poland	Sweden	H4-1701	2 790 227	1.13%
2016	Export	Poland	Mongolia	H4-1701	2 369 033	0.96%
2016	Export	Poland	Denmark	H4-1701	2 532 022	1.02%
Suma					227 836 061	100%

Source: UN Comtrade, own processing, 2017

Table 18: The most important export destination of Polish sugar industry.

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value	Share
2016	Import	Poland	World	H4-1701	114,124,905	100.00%
2016	Import	Poland	Sudan	H4-1701	24,739,488	21.68%
2016	Import	Poland	Zimbabwe	H4-1701	17,542,325	15.37%
2016	Import	Poland	Mozambique	H4-1701	14,883,948	13.04%
2016	Import	Poland	Germany	H4-1701	14,200,067	12.44%
2016	Import	Poland	Lithuania	H4-1701	10,119,752	8.87%
TOP5					81485580	71.40%
2016	Import	Poland	Sweden	H4-1701	8,736,605	7.66%
2016	Import	Poland	Mauritius	H4-1701	5,624,101	4.93%
2016	Import	Poland	Czechia	H4-1701	4,919,229	4.31%
2016	Import	Poland	Denmark	H4-1701	3,420,576	3.00%
2016	Import	Poland	Ukraine	H4-1701	1,879,914	1.65%
TOP10					106,066,005	92.94%
2016	Import	Poland	France	H4-1701	1,390,992	1.22%
2016	Import	Poland	Netherlands	H4-1701	1,121,101	0.98%
2016	Import	Poland	Brazil	H4-1701	950,492	0.83%
2016	Import	Poland	Colombia	H4-1701	749,977	0.66%
2016	Import	Poland	Austria	H4-1701	736,365	0.65%
TOP15					111,014,932	97.27%
2016	Import	Poland	United Kingdom	H4-1701	642,017	0.56%
2016	Import	Poland	Cambodia	H4-1701	535,896	0.47%
2016	Import	Poland	Slovakia	H4-1701	395,269	0.35%
2016	Import	Poland	Argentina	H4-1701	326,897	0.29%
2016	Import	Poland	Belgium	H4-1701	242,498	0.21%
2016	Import	Poland	Rep. of Moldova	H4-1701	164,171	0.14%
2016	Import	Poland	Italy	H4-1701	144,014	0.13%
2016	Import	Poland	United Arab Emirates	H4-1701	141,240	0.12%
Suma					113,606,934	99.55%

Source: UN Comtrade, own processing, 2017

Table 19: The most important import destination of Polish sugar industry.

Country	LFI	Country	TBI	Country	RCA
Austria	-0.123	Austria	-0.48	Austria	0.111
Belgium	0.487	Belgium	0.913	Belgium	1.154
Bulgaria	0.18	Bulgaria	1	Bulgaria	0.487
Croatia	0.001	Croatia	1	Croatia	0.01
Cyprus	0.169	Cyprus	1	Cyprus	0.762
Czechia	-0.085	Czechia	0.388	Czechia	0.694
Denmark	0.027	Denmark	-0.149	Denmark	0.539
Estonia	0.175	Estonia	0.987	Estonia	1.28
Finland	0.007	Finland	1	Finland	0.033
France	-0.083	France	-0.438	France	0.056
Germany	0.343	Germany	0.634	Germany	0
Greece	2.12	Greece	0.997	Greece	4.477
Hungary	0.793	Hungary	0.992	Hungary	1.77
Ireland	0.054	Ireland	0.993	Ireland	0.204
Italy	0.449	Italy	0.98	Italy	1.052
Latvia	1.456	Latvia	1	Latvia	4.926
Lithuania	-0.415	Lithuania	0.247	Lithuania	3.107

Source: UN Comtrade, own processing, 2017

Table 20: Comparative advantages of Polish sugar exports toward EU countries (2016) (to be continued).

Country	LFI	Country	TBI	Country	RCA
Luxembourg	0.703	Luxembourg	1	Luxembourg	2.605
Malta	0	Malta	1	Malta	0.003
Netherlands	0.039	Netherlands	0.326	Netherlands	0
Portugal	0	Portugal	1	Portugal	0.001
Romania	0.055	Romania	1	Romania	0.303
Slovakia	0.145	Slovakia	0.794	Slovakia	0.487
Slovenia	-0.005	Slovenia	-0.515	Slovenia	0.002
Spain	0.026	Spain	0.98	Spain	0.1
Sweden	-1.374	Sweden	-0.516	Sweden	0.711
United Kingdom	-0.023	United Kingdom	0.242	United Kingdom	0.058

Source: UN Comtrade, own processing, 2017

Table 20: Comparative advantages of Polish sugar exports toward EU countries (2016) (continuation).

Country	LFI	Country	TBI	Country	RCA
Algeria	0.002	Algeria	1	Algeria	1.674
Argentina	0	Argentina	-0.998	Argentina	0.033
Armenia	0	Armenia	1	Armenia	0.001
Australia	0.007	Australia	1	Australia	0
Azerbaijan	0.003	Azerbaijan	1	Azerbaijan	0.016
Bahrain	0.002	Bahrain	1	Bahrain	4.901
Barbados	-0.02	Barbados	-1	Barbados	0.001
Belarus	-0.031	Belarus	-0.169	Belarus	0.02
Belize	-11.836	Belize	-1	Belize	0
Bosnia Herzegovina	-0.252	Bosnia Herzegovina	-1	Bosnia Herzegovina	0
Brazil	-0.039	Brazil	-1	Brazil	0
Bunkers	0	Bunkers	1	Bunkers	0.351
Cambodia	-0.817	Cambodia	-1	Cambodia	0
Cameroon	8.41	Cameroon	1	Cameroon	19.357
Canada	0.015	Canada	1	Canada	0.043
Colombia	-0.151	Colombia	-1	Colombia	0
Cook Isds	0	Cook Isds	1	Cook Isds	2.528
Cuba	-0.027	Cuba	-1	Cuba	0
Egypt	0.48	Egypt	1	Egypt	1.911
Georgia	9.382	Georgia	1	Georgia	29.776
Ghana	0.234	Ghana	1	Ghana	0.625
China	0.074	China	0.984	China	0.214
Iceland	0.012	Iceland	1	Iceland	0.048
India	0.002	India	1	India	0.04
Indonesia	-0.036	Indonesia	-1	Indonesia	0
Israel	2.961	Israel	1	Israel	11.779
Jordan	0	Jordan	1	Jordan	0.006
Kazakhstan	5.228	Kazakhstan	1	Kazakhstan	11.216
Kuwait	0	Kuwait	1	Kuwait	2.754
Kyrgyzstan	0.062	Kyrgyzstan	1	Kyrgyzstan	0.302
Lebanon	5.845	Lebanon	1	Lebanon	16.165
Libya	0	Libya	1	Libya	0.031
Malawi	-0.011	Malawi	-1	Malawi	0
Malaysia	0.002	Malaysia	1	Malaysia	0.013
Mauritius	-20.721	Mauritius	-1	Mauritius	0
Mongolia	0.05	Mongolia	1	Mongolia	11.248

Source: UN Comtrade, own processing, 2017

Table 21: Comparative advantages of Polish sugar exports toward non-EU countries (2016) (to be continued).

Country	LFI	Country	TBI	Country	RCA
Mozambique	-11.495	Mozambique	-1	Mozambique	0
Myanmar	9.452	Myanmar	1	Myanmar	26.348
Norway	0	Norway	1	Norway	0.003
Oman	0.005	Oman	1	Oman	8.775
Pakistan	0.001	Pakistan	1	Pakistan	0.005
Paraguay	0	Paraguay	-1	Paraguay	0
Qatar	0.026	Qatar	1	Qatar	1.859
Rep. of Korea	0.033	Rep. of Korea	1	Rep. of Korea	0.162
Rep. of Moldova	5.298	Rep. of Moldova	0.895	Rep. of Moldova	11.753
Russian Federation	0.982	Russian Federation	1	Russian Federation	2.504
Saudi Arabia	0.001	Saudi Arabia	1	Saudi Arabia	0.476
Senegal	0	Senegal	1	Senegal	0.013
Singapore	1.558	Singapore	1	Singapore	13.958
South Africa	0.474	South Africa	1	South Africa	1.051
Sri Lanka	29.112	Sri Lanka	1	Sri Lanka	81.557
Sudan	-7.441	Sudan	-0.672	Sudan	74.32
Swaziland	-0.002	Swaziland	-1	Swaziland	0
Sweden	-1.374	Sweden	-0.516	Sweden	0.711
Switzerland	-0.006	Switzerland	-0.809	Switzerland	0.001
Syria	4.065	Syria	1	Syria	19.464
Thailand	0	Thailand	-1	Thailand	0
Turkey	0.347	Turkey	1	Turkey	1
Turkmenistan	0	Turkmenistan	1	Turkmenistan	3.571
Ukraine	-0.188	Ukraine	-0.987	Ukraine	0
United Arab Emirates	0.046	United Arab Emirates	0.925	United Arab Emirates	4.462
USA	-0.001	USA	0.118	USA	0.036
World	0.157	World	0.369	World	1.031
Zimbabwe	-18.116	Zimbabwe	-1	Zimbabwe	0

Source: UN Comtrade, own processing, 2017

Table 21: Comparative advantages of Polish sugar exports toward non-EU countries (2016) (continuation).

to most of its trade partners. From the perspective of comparative advantages, it is crucial that Poland achieved comparative advantages over most of the EU member states (18 EU countries: Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, Germany, Greece, Hungary, Latvia, Luxembourg, the Netherlands, Romania, Slovakia, Spain). Poland also reached positive trade balance in relation to 22 EU member countries (Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Romania, Slovakia, Spain, United Kingdom). In addition, Poland exhibit revealed comparative advantage toward eight EU member states (Belgium, Estonia, Greece, Hungary, Italy, Lithuania, Latvia, Luxembourg).

As far as third countries are concerned, Poland exhibit revealed comparative advantage toward 24 non-EU countries (Algeria, Bahrain, Cameroon, Cook Islands, Egypt, Georgia, Israel, Kazakhstan, Kuwait, Lebanon, Mongolia, Myanmar, Oman, Qatar, Moldova, Russian Federation, Singapore, South Africa, Sri Lanka, Sudan, Syria, Turkmenistan, United Arab Emirates) (Table 21). In bilateral relations, comparative advantage (LFI) was proved over 32 non-EU countries (Azerbaijan, Bahrain, Cameroon, Canada, Egypt, Georgia, Ghana, China, Iceland, India, Israel, Kazakhstan, Kyrgyzstan, Lebanon, Malaysia, Mongolia, Myanmar, Saudi Arabia, Singapore, South Africa, Sri Lanka, Syria, Turkey, United Arab Emirates). In 2016, Poland's positive sugar trade balance was reported for 40 non-EU trading partners (Algeria, Armenia, Australia, Azerbaijan, Bahrain, Cameroon, Bunkers, Canada, Egypt, Georgia, Ghana, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Libya, Malaysia, Mongolia, Myanmar, Norway, Oman, Pakistan, Qatar, Korea, Moldova, Russia, Saudi Arabia, Senegal, Singapore, South Africa, Sri Lanka, Syria, Turkmenistan, United Arab Emirates, USA). Generally, Poland was able to exhibit bilateral and well as absolute comparative advantages in relation to the third countries.

Conclusion

The analysis shows the following findings in relation to Polish sugar production and sugar markets. Polish market underwent significant restructuring that on one side resulted in significant reduction of amount of sugar refineries and sugar beet producers. On the other hand, it resulted in considerable concentration of production capacities among subjects that successfully passed the transformation phase. Total amount of farmers producing sugar beet decreased from about 112 thousand in 2000 to just 34 thousand in 2017. At the same time, the number of sugar refineries decreased from 76 to 18. Although this reduction seems to be very drastic, in reality, sugar sector was able to absorb successfully this change and finally the sector became much stronger. Between 2000 and 2017, total sugar beet production is almost unchanged at the level of 12 million tonnes. The decline in sugar beet harvested area was substituted by a significant increase in yields and by an increase in average sugar content. Average harvested area per one farm increased, but still, Polish producers belongs among the smallest in the whole EU. In comparison to German or French producers their average harvested area is less than half. Relatively small farms are getting additional national coupled support for sensitive sugar beet production. It equalled to about 380 EUR per hectare. In comparison to for example Czech Republic or Italy, this value was by more than 100 EUR higher.

Also, raw sugar production remained almost unchanged and during the period oscillated around the level of 2 million tonnes. On contrary, production of white sugar increased significantly from 1.54 in 2001 to almost 2.1 million tonnes in 2016. Reduction of sugar refineries was in this perspective compensated by the modernisation of those production facilities that were able to survive. Investments totalled about 1 billion EUR. At the same time, refineries increased their processing capacities. Between 2001 and 2016 length of sugar campaign increased from average 51 days to about 112 days. The average processing capacity of one sugar refinery grew by tens of percent and reached 6,351 tonnes a day (installed processing capacity of the smallest refinery is 3,500 and the capacity of the biggest refinery is 12,200 tonnes per day). The general stability of the Polish market has one forfeit – extreme concentration. Only four players (Krajowa Spolka Cukrowa S.A., Nordzucker Polska S.A., Pfeifer&Langen, Südzucker Polska S.A.) control

all production capacities. The market is highly oligopolistic, dominated by three subjects: state-owned Krajowa Spolka Cukrowa, Südzucker and Pfeifer&Langen (both owned by German capital). Polish market is highly dominated by German influence, since companies controlled by German capital control approximately 56 percent of installed production capacities and produce more than 60 percent of white sugar.

The transformation process of Polish sugar industry did not significantly damaged sugar exports. Although volume of export significantly fluctuated, from the long-term perspective it oscillates around 0.5 million tonnes annually. Increasing unit price per kilogram of exported sugar is considered as a positive and important factor that pushed total value of exports to approximately 240 million EUR in 2017. Opposite to exports, volume of imports rose dynamically from 55 ths. tonnes in 2000 to more than 200 ths. tonnes in 2017. The total value of imports grew much slower than value of exports. Imports oscillates around 100 million EUR and makes sugar trade balance positive in the long-run. Polish sugar export is strongly oriented toward EU countries, while significant portion of imports originate in non-EU countries, in particular in countries with preferential access to EU markets under General System of Preferences. It is also important to mention that Poland has a considerable export potential and its exports are very competitive especially in comparison to other EU countries. However, more dynamic production development was disabled by system of production quotas (valid until 10/2017) that limited production of Polish sugar at the level of 1.4 million tonnes a year.

Results of the competitiveness analysis of sugar foreign trade concluded, that Polish sugar exports have a considerable potential. But extreme territorial concentration is seen as weak point. Top 10 countries participate on Polish exports and imports with sugar approximately by 72.56% and 92.94% respectively (2016). The main partners of Polish exports are Germany, Israel, Lithuania, Italy and Latvia, while main importers are Sudan, Zimbabwe, Mozambique, Germany and Lithuania. At present, significant restructuring in the Polish sugar industry can be observed because of changes in EU's sugar policy (abolition of sugar quotas). General changes in EU legislative environment raise a question, whether Poland will further strengthen its position on the European sugar market or whether the sugar market will suffer as a result of the restructuring of the sugar market, which is expected to be run by multinational actors

in the European sugar market. Further possible export development might be oriented toward Asian markets, as Asian countries are the largest importers of Sugar (Svatoš et al., 2013), but China as one of the largest importer still maintains tariff quotas (Pawlak et al., 2016).

To conclude, what are the specifics of Polish sugar industry? Definitely Poland is third largest sugar producer in the whole EU, but to sustain its sugar market the whole industry needed to overcome difficult times after EU accession. Production of beet is secured by very small farms. Production of sugar is not only in hand of private companies, but large portion of production is still controlled by the state. Sugar-refineries not controlled by the state are controlled by only foreign capital (German). Limited number of surag producers creates a situation which leads toward monopolistic competition with significant concentration. Polish sugar export has considerable potential, but its limited export territorial concentration is seen as a weak point.

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