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PORK MARKET IN POLAND AFTER THE EU ACCESSION

Abstract:

Pork production in Poland has a significant economic, social and environmental impact. Favourable natural conditions as well as the tradition and consumption patterns have made Poland, producing 2.5-2.8 million tonnes of pig livestock (in liveweight), one of the biggest producers in the EU. The pig sector is not only one of the most important branches of the Polish agri-food economy, but is also considered one of the most sensitive ones (Rowinski, Tereszczuk 2008). What makes it so important is its large share in commercial production and agricultural income, sales revenue and employment, as well as a high level of pork consumption and its share in consumers' food spending. Following Poland's accession to the EU, the development of the pig sector has been more hindered than the production and processing of poultry, milk and beef. Poland has become a shortage country in pork production, the share of imports in the supply of the domestic market has increased to 40%, and the negative balance of foreign trade in pork reached in 2016 220 thousand tonnes in a meat equivalent and EUR 342 million. The article presents the changes taking place on the pork market in Poland in 2004-2016 and indicates the factors determining them. Problems relating to pork production are mainly due to: fragmented farm structure compared to those in EU-15 Member States, decreasing share of pork in agricultural commercial production und in the total meat production, low price competitiveness, problems with ASF in the eastern regions of Poland and hindered exports due to an embargo imposed by Russia.

Keywords:

pig livestock, structure of pig farming, industrial processing, pig market, supply chain, foreign trade, prices and profitability

JEL Classification: Q11, Q13, Q17

1 Pig livestock production

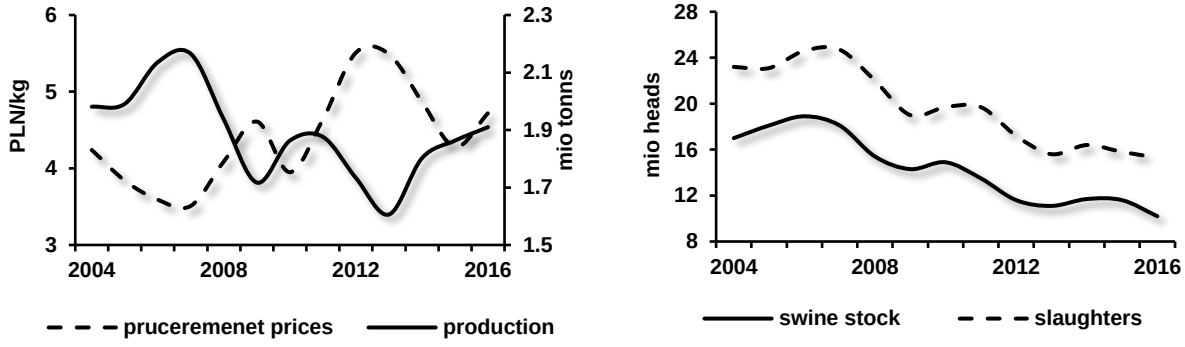
1.1 Pig livestock production

In 2004-2016, there were significant changes in pork production in Poland [Swietli, Seremak-Bulge 2007]. Pork production decreased by approx. 3% to 2.5 million tonnes in liveweight, and to 1.9 million tonnes in post-slaughter weight. Pork production showed a downward trend and cyclical fluctuations, which occur in most countries and are referred to, in agricultural economics, as “pig cycle”. Cyclical fluctuations are strongly correlated with buying-in prices of pig livestock (Zawadzka 2010). When pig production is high, buying-in prices of pigs drop, to increase when pig production shows a downturn trend. In recent years, pork production has shown an upward trend, as it was by 19% higher in 2016 than in 2013.

In 2004-2016, pig livestock in Poland decreased by approx. 40% to 10.2 million heads, of which the livestock of sows decreased by 50% to 0.8 million heads. The share of sows in pig livestock decreased from 9,4 in 2004 to 7.5% in 2016. In 2011, sows accounted for only 6.7% of total pig livestock. The slaughter of pigs decreased by 24% to 15.3 million heads (Rynek miesa ... 2016).

There were major changes in the pork production patterns, as imports of live pigs significantly increased since 2008, to approx. 6.4 million heads, in particular those of piglets which were fattened in Polish farms. Heavy imports of piglets result in a lower interest in breeding sows and piglet production. The meat sector expects large batches of raw material with specific pork meat parameters, hence the pressure of heavy imports of meat. As a result, large farms specializing in pork production import breeding piglets which are characterized by high fattening efficiency. This is primarily due to the efficient use of fodders and protein concentrates as well as significant daily weight gains.

Figure 1. Swine stock, slaughters, meat production and procurement prices



Source: GUS, Rynek mięsa. Stan i perspektywy (2016): Institute of Agricultural and Food Economics – National Research Institute, Agricultural Market Agency, Ministry of Agriculture and Rural Development, Warsaw.

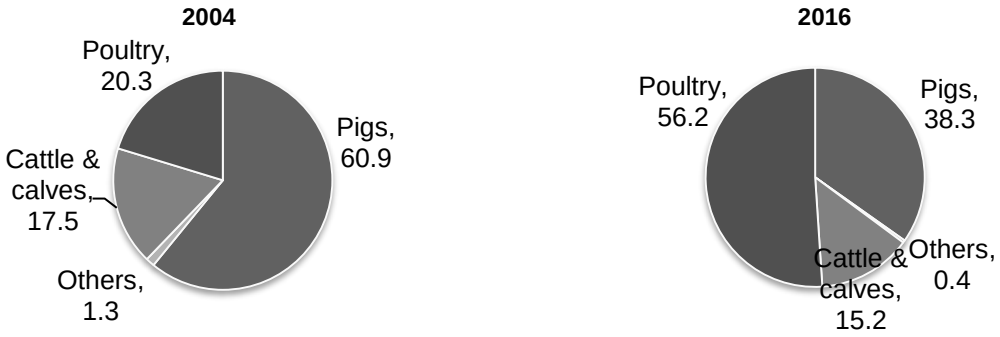
Table 1. Swine stock and pig meat production in Poland

Year	Swine stock (mio. heads)		Pig slaughter (mio. heads)	Average weight at slaughter (kg)	Pig meat production in deadweight ('000 tonnes)
	total	sows			
2004	17,0	1,6	23,2	109	1 981
2005	18,1	1,6	23,1	111	1 991
2006	18,9	1,8	24,6	113	2 136
2007	18,1	1,6	24,7	112	2 165
2008	15,4	1,3	22,0	113	1 936
2009	14,3	1,2	19,0	116	1 717
2010	14,9	1,1	19,7	120	1 863
2011	13,5	0,9	19,7	122	1 876
2012	11,6	1,2	17,2	129	1 733
2013	11,1	1,1	15,6	132	1 606
2014	11,7	1,0	16,4	141	1 802
2015	11,6	0,9	15,8	149	1 863
2016	10,2	0,8	15,3	152	1 910

Source: GUS, Rynek mięsa. Stan i perspektywy (2016): Institute of Agricultural and Food Economics – National Research Institute, Agricultural Market Agency, Ministry of Agriculture and Rural Development, Warsaw.

In 2004-2015, the share of pork in the structure of commercial production value of Polish agriculture decreased from 23.5% to 13.3%. This was due to a decline in pork production and increased production of other agricultural products, in particular poultry, milk and plant products (cereals, rape, apples). Major changes occurred also in the structure of meat production. In 2005-2015, the share of pork in the total meat production decreased from 60.9% to 38.3%. At the same period, there was a significant increase in poultry production, whose share in the total meat production increased from 20.3% to 56.2%. There was also a slight increase in beef production. In the case of both poultry and beef, production was driven by increasing exports. Pork is produced primarily to supply the domestic market.

Figure 1. Structure of production of animals for slaughter (live weight)



Source: GUS.

In Poland, ASF was first diagnosed in boards in April 2014, in the Podlaskie Voivodeship. Within three years, in spite of intensive preventive measures, the number of ASF outbreaks has increased to 70. Outbreaks have been found also in the Mazowieckie and Lubelskie Voivodeships. It is extremely difficult to control ASF - it took about 30 years to eradicate it in Spain (Sánchez-Vizcaínojmvizcaino 2017). In Poland, the situation is aggravated by a very large population of wild boars that spread the virus. The central government as well as local governments struggle to stop the increase in the number of ASF cases, as the spread of the disease results in

considerable economic losses. These are due to, in particular, problems with exports. There is also a risk of a decline in demand on the domestic market.

1.2 Structure of pig farming

Pork production in agriculture has undergone very extensive structural and modernization changes since the beginning of the system transformation. The structural changes have been related primarily to concentration of production in large farms. In the analysed period, production was abandoned by the smallest and ineffective farms which were unable to take advantage of economies of scale and generated high costs, in particular high fixed costs. Small farms were unable to carry out necessary investments to meet required veterinary standards. In 1996-2010, the number of pig farms decreased by 64% to 398 thousand, while the average herd size increased from 12 to 37 pigs. In 2015, the number of farms producing pork decreased to approx. 280 thousand, while the average herd size increased to approx. 45 pigs. Pork production in Poland is still characterized by a very fragmented structure compared to its main competitors from the EU-15. In Denmark, Ireland and the Netherlands, the average pig herd numbers more than 1,100 heads. In Belgium, France, Spain, Germany and the United Kingdom, 300-800 pigs are kept in a farm on average. The scale of production there is hence many times greater than in Poland. Significant economies of scale determine high production efficiency, which is the basis for building up competitive advantage. As a result, Poland imports large numbers of piglets for breeding and significant quantities of meat from Denmark, the Netherlands and Germany.

The structure of pork production in Poland is extremely fragmented, as approx. 67% of farms kept 1-9 pigs in 2010. In the EU-15, there are practically no such small producers. Farms with a significant scale of production (>200 heads) accounted for only 2.5% of all pork producers. It should be noted, however, that the decisive role in the market is played in fact by large and medium-sized farms (100-199 heads) which kept together approx. 60% of pigs. As regards the smallest farms, these kept only 11% of livestock.

In 2016, the process of concentration of pig breeding in large farms in Poland enhanced. Farms with a scale of production of over 200 pigs kept 66.2% domestic pig livestock. 39.4% of domestic pig livestock was kept in very large farms (>1,000 pigs), while farms with more than 5,000 pigs kept 23.5% of pig livestock. The share of the smallest farms in total pig livestock decreased to 5.7%. Increased concentration can be seen also in the structure of pig farms, as the share of the smallest entities decreased to 56%, while that of the largest ones increased to 6%.

The situation of Polish producers is aggravated by the fact that despite profound fragmentation, there is no development of vertical and horizontal integration. Ownership changes in farms and in the meat sector were not used to develop integration in the pork sector. The development of pork producer groups is also too slow, in spite of legal regulations that enable obtaining EU support and opportunities in this regard. One of the most important reasons for the poor development of pig

producer groups is the meat sector's reluctance to collaborate with such groups. This is a serious problem for the meat industry, which due to the fragmented structure of pig producers incurs higher transaction costs. This results in high costs and low price and cost competitiveness of Polish pork, low income and a poor position of producers and processing entities relative to dynamically developing trade, especially in the context of increasing international trade.

Table 2. Share of farms in the pig population per the scale of breeding in Poland

Herd size in items	2000		2010		2016	
	per cent of farms	per cent of swine stock	per cent of farms	per cent of swine stock	per cent of farms	per cent of swine stock
1-19	72,4	23,4	67,3	11,0	56,0	5,7
20-49	18,5	26,8	18,5	14,7	22,0	8,7
50-99	6,0	19,4	7,8	13,9	10,1	9,1
100-199	2,3	14,7	3,8	13,4	5,9	10,3
>200	0,8	15,7	2,5	47,0	6,0	66,2

Source: GUS

Polish farms producing pork have undergone not only a process of structural changes, involving concentration of production in large and medium-sized farms. These processes were accompanied also by considerable technological progress. Farms had to adapt to the high sanitary and veterinary standards in force in the EU. Very significant changes occurred also in pig feeding. Farms completely abandoned feeding pigs with evaporated potatoes – an important pig feed in the 1980s and 1990s. Cereal and protein feed consumption significantly increased. According to surveys conducted by the Institute of Agricultural and Food Economics – National Research Institute, the use of cereal for feed increased in Poland in 2000-2016 by approx. 10% to 16.6 million tonnes. The increase in cereal consumption was relatively small compared to changes in animal production, including rapidly growing poultry production (Dybowski, Rycombel 2011). In the same period, the consumption of protein feed (soybean meal and rapeseed meal) increased two and a half times to 3.5 million tonnes (Rynek pasz …2017). Progress in nutrition is reflected in the change of cereal consumption structure. The consumption of non-processed cereals dropped by 20% to 10.3%, while that of cereals in the form of compound feeds increased two and a half times to 6.3 million tonnes. This confirms that large farms use ready-made and well-balanced compound feeds. As regards the consumption of protein feeds, the shares of soybean meal and rapeseed meal grew rapidly to 2.2. million tonnes and 0.9 million tonnes, respectively. It should be noted, however, that the development of production and consumption of industrial feeds has been largely affected by the dynamically growing poultry production, as well as technological progress in pork production. In large farms, the consumption of cereal feeds and protein feeds per kg of pig weight increase is approx. 2.8 kg, while in small farms, this is approx. 4.5 kg.

1.3 Regional differentiation of pork production

Pork production in Poland is much diversified regionally. It is concentrated in five Polish regions which produced in 2015 a total 1.6 million tonnes of pork in liveweight, which accounted for 67.4% of total production. The Wielkopolskie Voivodeship has the greatest share in pork production (approx. 26%). The other four regions, i.e. the

Kujawsko-Pomorskie, Mazowieckie and Lodzkie Voivodeships have shares in the domestic production of approx. 10% each. Southern and western regions of Poland have the smallest share in pork production. In the southern regions (e.g. the Małopolskie, Swietokrzyskie and Podkarpackie Voivodeships), there are a lot of small farms in which production is not economically viable due to insignificant economies of scale. In the western regions there are big farms specializing in plant production.

Polish regions specialized in pork production are characterized by high volumes of this production per 100 ha of agricultural land. Pork production in these regions has also a significant share in commercial agricultural production. In Wielkopolska, this production accounted for 21.2% of the market value of agricultural production. In the Pomorskie and Kujawsko-Pomorskie Voivodeships, the share of pork in agricultural production accounted for 28.2% and 24.5%, respectively. In the Mazowieckie Voivodeship, pork production is high, so is the production of milk, fruit, vegetables and other products. As a result, pork accounts in this region for only 8.3% of the market value of agricultural production.

The greatest pork production per 100 ha of agricultural land is recorded in the following voivodeships: Wielkopolskie (243 kg), Kujawsko-Pomorskie (125 kg), Łódzkie (106 kg) and Pomorskie (100 kg). In the Mazowieckie Voivodeship, pork production per 100 ha of agricultural land was small (50 kg), as part of agricultural land is used there for plant and milk production.

Table 3. Regional differences in pig meat production in Poland (2016)

Wyszczególnienie	Share of pig meat in marketed agricultural production in %	Swine stock		Pig meat production in '000 tonnes (life weight)
		'000	per 100 Ha UR	
Polska	**13,3**	**11 641**	**80,0**	**2353,7**
Dolnoslaskie	2,5	210	231,0	21,1
Kujawsko-Pomorskie	24,5	1 325	124,5	262,2
Lubelskie	12,1	575	39,8	166,6
Lubuskie	9,2	144	36,8	33,1
Lodzkie	18,8	1 028	105,7	253,1
Małopolskie	11,0	190	35,3	50,8
Mazowieckie	8,3	974	50,4	243,6
Opolskie	14,1	412	83,0	68,3
Podkarpackie	14,4	167	29,1	44,9
Podlaskie	9,0	337	31,9	98,1
Pomorskie	28,2	762	100,2	215,6
Slaskie	13,7	252	70,5	56,0
Swietokrzyskie	11,6	231	48,0	59,1
Warmińsko-Mazurskie	13,1	525	52,8	118,8
Wielkopolskie	21,2	4 214	242,6	612,0
Zachodniopomorskie	8,6	295	35,2	50,4

Source: Rocznik Statystyczny Rolnictwa 2016, GUS, Warszawa 2017.

2 Industrial processing of pork

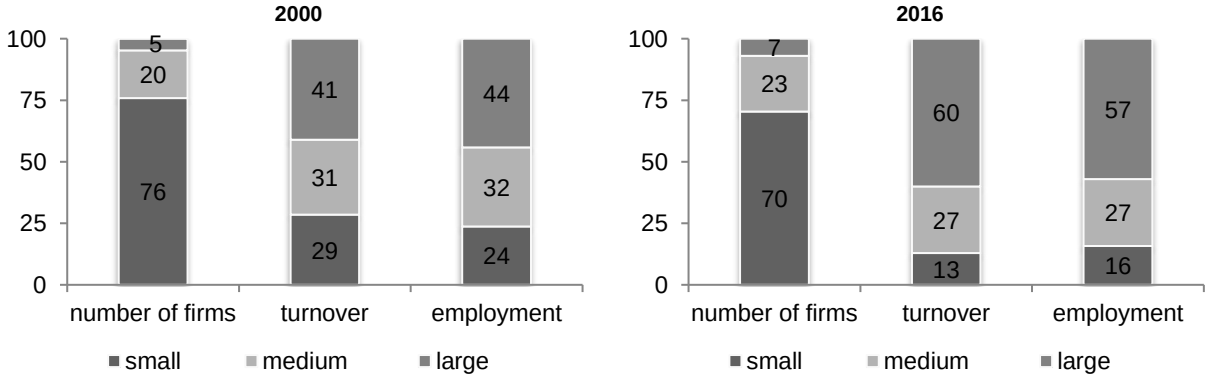
Processing of red meat is an important segment of the Polish food industry. In 2015, the share of the meat industry in sales revenue of the food industry amounted to approx. 26%, while that in employment - to approx. 45%. Changes in market conditions, as well as growing requirements as regards sanitary and veterinary standards, have resulted in intensive structural and modernization changes in slaughter and pork processing. In 2000-2015, the number of large companies (>249

employees) operating in the meat sector increased by 25% to 74. In the same period, the number of small operators (10-49 employees) decreased by 30% to 746, while the number of medium-sized ones (50-249 employees) dropped by 14% to 239. As regards the structure of the number of enterprises, the share of small companies decreased to 70%, while that of large ones increased by 7%.

The increased concentration in the meat sector is reflected in changes in the sales revenue structure. In 2000-2015, the sales value in the meat industry increased two and a half times to approx. PLN 45 billion. Large companies' share in this revenue structure increased from 41% to 60%. In the same period, small companies' share in sales in the meat industry decreased from 29% to 13%. The meat industry concentration process is reflected also by changes in the employment structure. In 2000-2015, employment increased by 5% to approx. 94 thousand. Large companies' share in employment increased from 44% to 57%. The smallest enterprises employed 16% of meat industry workers, compared to 24% in 2000.

The structure of the Polish meat industry is extremely fragmented compared to those in the EU-15 Member States, and the industry is not (vertically) integrated with farms producing pork. As a result, the marketing chain effectiveness is very low and there is strong competition in the sector between farmers and the meat industry [Rycombel 2007].

Figure 2. Structure of meat industry in Poland



Source: GUS, own calculations.

Significant changes in the processing capacity of the meat industry took place during the period of adaptation to integration with the EU. Companies' adaptation to veterinary standards required first and foremost thorough modernization and restructuring of the slaughter part. Industry leaders modernized slaughterhouses, among other things, installed efficient slaughter lines for pigs. Most small and medium-sized enterprises resigned from performing slaughter on their own and developed their capacity to cut and process meat. In 2003-2016, the nominal value of investment for the modernization of the meat industry and the development of its production capacity amounted to approx. PLN 14 billion, i.e. approx. PLN 1 billion a year on average. Investment support under EU programs played also an important role in the modernization of plants. The Polish meat industry is one of the food industry sectors that are characterized by a small share of direct foreign investment of global meat

companies (Czyzewski, Poczta-Wajda 2011). There are in fact only two transnational meat companies in the meat sector: Smithfield Foods and Danish Crown. It is estimated that the share of global companies in sales revenue in the meat industry amounts to approx. 16% (Chechelski 2017), (Robinson 2004) As a result of restructuring and modernization processes, there has been an increase in the meat industry's capacity in:

- slaughter - to 4.5-5.0 million tonnes of hot carcass weight,
- cutting - to approx. 3.0 million tonnes,
- production of processed products - to approx. 2.0 million tonnes, of which the production of cold meats - to approx. 1.8 million tonnes.

As a result of investment processes, the meat industry has been modernized. All plants meet sanitary and hygienic requirements and their products have been approved for sale on the EU market. The introduction of the so-called "hygiene package" has made pork producers and pork processing entities responsible for the quality of products marketed by them and has regulated official control procedures. This required the introduction of new regulations, directives and recommendations[1]. Hygiene requirements, referred to as Good Hygiene Practices (GHP) and Good Manufacturing Practices (GMP) were imposed on enterprises to enable the introduction of the HACCP system. This relates to, in particular, providing adequate infrastructure (buildings and their finishing as well as equipment, systems, machinery and control and measuring equipment) as well as procedures and equipment which enable to meet hygiene standards (cleaning and disinfection, waste management, etc.) (Bardají, Iráizoz, Rapún 2009).

The Polish meat industry was subject to difficult accession negotiations. Adoption, as of the date of becoming an EU Member State, of the acquis communautaire in this area would have been tantamount to the obligatory suspension of operation of a large number of plants that failed to adapt to the EU veterinary standards in the period preceding Poland's accession to the EU, until they eliminated any shortcomings. As a result of negotiations, a transitional period until 31 December 2007 was introduced and applied to 270 plants. A schedule of adaptation work was prepared for each of these plants, whose implementation was controlled by the Polish and EU veterinary services. According to data of the Polish Veterinary Inspection, all plants in enterprises producing food of animal origin apply GHP, GMP and HACCP (Morkis 2009). Following HACCP principles is considered as significant support for meat industry operators, which facilitates the accomplishment of food safety objectives. These principles are flexible and suitable for use in small enterprises.

[1] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January2002 laying down the general principles and requirements of food law, establishing the European Food SafetyAuthorityand laying down procedures in matters of food safety. Regulation (EC) No 852/2004 OF THE European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin. Regulation (EC) No 854/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption.

Polish farmers find it difficult to meet current requirements of processing entities, both in terms of the quality of produced pigs for fattening and offered prices. At present, lean meat is in demand, which is associated with the tendency to eliminate animal fats from the diet (Roeber, Cannell … 2000). Farmers make efforts to produce pigs with high meatiness. Although the EUROP pig carcass classification system was implemented in Poland in the 1980s, it was not applied in all plants. The EUROP system involves estimating post-slaughter meatiness, followed by the assessment according to meatiness classes: S, E, U, R, O and P. The post-slaughter rating resulted in the increased use of highly meaty pig breeds in production. Based on the EUROP assessment, an approx. 85% share of highly meaty carcasses of class S, E and U (meatiness level of more than 55%) is recorded, and only an approx. 4% share of defatted carcasses of class O and P (meatiness level below 45%).

Poland is one of the EU Member States with high consumption of meat preparations relative to that of culinary meat. In recent years, this proportion has been changing and consumption of meat preparations has been decreasing in favor of culinary meat, whose current share is estimated at 43%. Representatives of the sector are aware that this process will be accelerated due to nutritional recommendations (according to which the share of meat preparations in meat consumption should not exceed 30%). Therefore, increasingly more attention is paid to the quality of culinary pork. Since 2010, a program for producing pork in the Pork Quality System (PQS) has been implemented. This system has been acknowledged by the Minister of Agriculture as the national food quality system. The main objective of the PQS is production of lean, unprocessed pork, while preserving quality parameters of importance to consumers and processing entities. The system requires the implementation of specific standards in agricultural production (e.g. appropriate pig breeds and feeding rules), as well as in processing and distribution of meat products, which affect the final quality of the product and guarantee that high-quality pork will be obtained. Meat produced in the PQS should be characterized by a number of favourable parameters which extend its shelf life and enhance the culinary and processing qualities as well as its palatability and attractiveness for consumers. The system is voluntary and open to any participant in the production chain that will comply with its requirements.

Consumers' requirements force farmers and the food industry to implement a comprehensive quality assurance system. The pig sector may implement also Quality Assurance Food Programme (QAFP) which uses risk analysis and management as well as objective measures for the assessment and prevention of hazards to animal welfare and human health. This system sets standards to be met by an entity dealing with pig breeding, transport and slaughter as well as pork cutting and distribution. The description of the system includes the definition of pork, its characteristics and types, as well as requirements concerning pig farming, in particular animal feeding and welfare. Rules for buying-in pigs and transport of livestock as well as the procedures to be followed during slaughter have also been specified. The description of the system includes also the rules for pork quality control, procedures applicable to the maturing of culinary meat and requirements for culinary meat portioning and

packaging, as well as transport and sales conditions. In 2007-2016, production of pork for consumption increased by 12.5% to 849.5 thousand tonnes, while that of canned meat doubled to 118.7 thousand tonnes.

Table 4. Production of pig products in plants employing more than nine staff as well as financial indicators in Poland

Year	Production ('000 tonnes)		Profitability indicators		
	Cured meat	Tinned food	net profit in % of revenue	current liquidity	rate of investment
2003	685,4	-	0,85	1,03	2,22
2007	754,9	48,1	2,34	1,05	1,68
2008	708,7	59,5	1,42	1,04	1,41
2009	623,5	72,3	4,52	1,17	0,93
2010	729,4	104,7	3,25	1,20	1,18
2011	780,0	111,3	1,95	1,24	1,24
2012	764,1	119,8	2,12	1,22	1,22
2013	767,3	124,1	2,05	1,30	1,30
2014	775,3	114,0	2,98	1,34	1,34
2015	774,8	119,2	3,01	1,31	1,31
2016	849,5	118,7	2,45	1,32	1,33

Source: GUS, Rynek mięsa. Stan i perspektywy, nr 51, IERiGŻ-PIB, Warszwa, ARR, MRiRW, Warszawa, 2016.

As regards red meat processing, fragmentation and low utilization of the production capacity as well as high asset-related spending increasing processing costs remain the main problems in this area. Slaughterhouses' capacity is utilized in approx. 50%, that of cutting plants in approx. 70%, while that of processing plants in approx. 60%. This means that in spite of the technological development in meat processing, its increased efficiency, lower use of raw material per unit of meat product and better labor productivity, its profitability is low, but still more better after Poland's accession to the EU. However, low labor and energy costs as well as lower environmental fees make it possible for the Polish meat industry to compete in the EU market, in spite of its much lower labor productivity. What is still a problem are high transaction costs of buying in livestock, sales organization and poor marketing capabilities of small companies. Overcapacity and a fragmented structure are the key reasons for competition in the Polish meat sector, which is manifested primarily in a strategy of fierce price competition in pig buying-in and sales of products.

3 Foreign trade

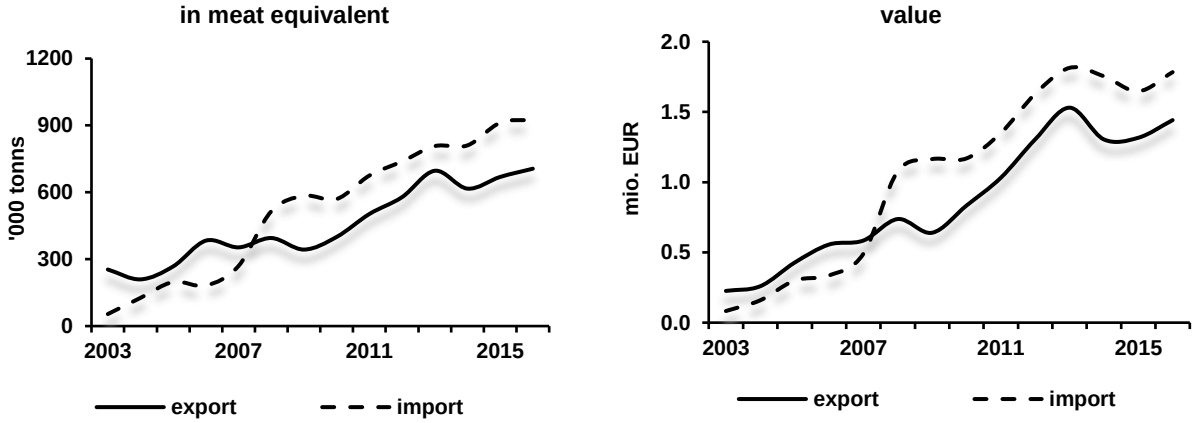
3.1 Exports, imports and trade balance

Foreign trade plays an important role in offsetting the supply and demand on the Polish market for pork, whose production is characterized by specific cyclicality and periodic surpluses or shortages of supply. Exports help to manage excess supply at the upward stage of the pig cycle, while increased imports cover shortages at the downward stage (Hallam 2006). In 2004-2006, the performance of foreign trade in pork and pork products in Poland was strongly correlated with the production of pig livestock. In years of high production of pig livestock (approx. 2.2 million tonnes) and Poland's self-sufficiency within the range of 104-110%, the sector generated a positive foreign trade balance of 0.1-0.2 million tonnes in a meat equivalent. As regards the

value, the positive trade balance was in the range of EUR 80-25 million. The decline in pig livestock production in 2008-2016 to 1.6-1.9 million tonnes per year resulted in a significant excess of imports over exports reaching 0.1-0.3 million tonnes in a meat equivalent, and as regards the value – EUR 0.3-0.5 billion. In 2016, the value of exports of pork products amounted to EUR 1.4 billion, which accounted for approx. 6% of the value of Polish exports of agri-food products. Imports amounted to EUR 1.8 billion and accounted for approx. 10% of imports of agri-food products.

Poland's accession to the EU and the elimination of customs barriers resulted in rapid growth of the trade in pork in 2003-2016. The import growth rate was greater than that of exports, which resulted in an increase in the negative balance. The negative pork trade balance has been recorded uninterruptedly since 2008. Imports expressed in a meat equivalent increased in the period concerned by 19% per annum on average, while exports by only 9%. In 2003-2016, imports expressed in a meat equivalent increased fifteen times, while exports - two and a half times. Trade in terms of value showed an even greater growth rate due to rising transaction prices. Imports increased by approx. 22% per annum on average, whereas exports - by 14%. The integration with the EU and a strong link between the sector and the market characterized by high prices and high consumer purchasing power were the main drivers of price increases.

Figure 3. Foreign trade in pig sector



Source: CAAC, own calculations.

In 2004-2016, Poland self-sufficiency in pork production decreased from 110% to 91%, which resulted in a negative foreign trade balance. The share of imports in the supply of the Polish pig market increased from 2.7% to approx. 40%. Piglets fattened in Polish farms have a significant share in the import structure. Imports of pigs increased in the period concerned to 6.4 million heads, and their share in the pig population increased to 62.5%. In the same period, the share of exports in production, expressed in a meat equivalent, increased from 11.4% to approx. 35%. As a result, the intensity of intra-industry trade on the pig market increased significantly. The negative foreign trade balance, low value of the self-sufficiency index and a high share of imports in the supply indicate deterioration in the competitiveness of the Polish pork sector. The poor performance of foreign trade and low competitiveness on foreign

markets are mainly due to ineffective pig livestock production and the operation of the marketing chain in the pork sector, whose structure is fragmented and not integrated.

Table 5. Importance of foreign trade in pig sector

Items	2003	2005	2008	2010	2015	2016
Self-sufficiency	109,8	103,6	94,0	91,6	91,0	91,4
% share of export in pig meat production	11,4	13,4	20,2	21,5	34,5	34,8
% share of import on market – import penetration of market	2,7	10,3	25,0	28,0	40,4	40,4
% share of pig sector in agri food trade						
export	5,6	6,1	6,1			
import	2,1	4,2	9,4			
% share of imports in swine stock	0,0	2,2	7,3	15,4	47,9	62,5

Source: GUS, CIHZ, CAAC, own calculations.

3.2 Foreign trade commodity structure

Polish foreign trade in pork and pork products has a raw material nature, as it is dominated by meat and low-processed products (with low added value), both as regards quantities and values. This applies in particular to imports, which are almost completely dominated by meat for processing (carcasses) and live pigs (piglets). In 2003-2016, the share of unprocessed products in the import structure in a meat equivalent increased from approx. 84% to approx. 98%, of which the share of live pigs increased to approx. 23%. Live pigs (mainly piglets) are imported mainly from Denmark (4,8 mio. heads), Germany (0,6 mio. heads) and the Netherlands (0,3 mio. heads). Bulk import from Denmark reflects a high competitiveness of their pork sector as well as high quality due to genetic features the turns into very high efficiency of feeding. Major imports of livestock and chilled pork pose strong competition for domestic agricultural producers, which results in declining production and a negative foreign trade balance. The share of imported cold meats in the supply of the domestic market is marginal.

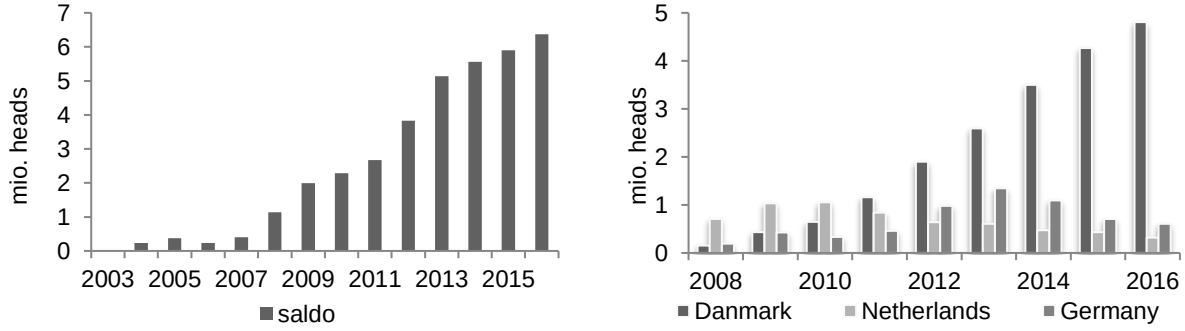
As regards the commodity structure of exports, there have been favorable changes in this area, as the share of final consumer products increased to 26.5%, yet the dynamics of these changes remain unsatisfactory. The greatest increase was recorded in the share of sausages (from 3% to 12%) and in the share of canned meat (from approx. 2% to approx. 6%). The share of hams in the export structure does not increase (approx. 4%), which is a very disturbing phenomenon. In the 1970s and 1980s, hams were the main Polish export product in the Polish food sector. This confirms deterioration of the international competitiveness of the sector, as exports concern currently only raw materials. The share of meat for processing, livestock and fats decreased from approx. 87% to 73.5%. These products still have a dominant share in exports. As a result, enterprises derive relatively small benefits from economies of scale and a high added value resulting from the production of final consumer products (e.g. cold meats).

Table 6. Structure of foreign trade in pork sector (meat equivalent)

Year	Export		Import	
	2003	2016	2003	2016
Livestock	0,0	1,0	0,0	22,6
Pig meat	79,2	62,3	80,7	75,3
Fat	7,5	10,1	3,1	0,5
Raw products	**86,7**	**73,5**	**83,8**	**98,4**
Sausages	3,0	12,3	2,2	0,6
Ham	4,0	4,1	0,2	0,2
Slated and smoked meat	4,6	4,3	13,8	0,3
Tinned products	1,8	5,8	0,0	0,4
Processed products	**13,4**	**26,5**	**16,2**	**1,6**
Total	**100,0**	**100,0**	**100,0**	**100,0**

Source:GUS, Rynek mięsa. Stan i perspektywy, nr 51, IERiGZ-PIB, Warszwa, ARR, MRiRW, Warszawa, 2016.

Figure 4. Import of pigs



Source: CIHZ, CAAC, own calculations.

3.3 Geographical structure of foreign trade

Changes in the commodity structure were accompanied by major changes in geographic directions, in particular after Poland's accession to the EU which has made the meat sector increasingly more linked with the EU market. Before that, large selling markets for Poland included primarily Russia and Ukraine. Exports to these countries were hindered, as they happened to impose temporary bans on exports. In April 2014, Russia imposed an embargo on Polish pork due to identified cases of ASF. Another embargo on selected EU foodstuffs, including pork, was introduced in August 2014[2]. The reason was a tense political situation caused by the armed conflict in Ukraine. Since 2014, the Polish pork sector has been facing serious difficulties in exporting pork to eastern markets, including Asia. Polish pork and pork products have been exported in recent years mostly to the UE and the USA, as well as some Asian countries that have lifted the embargo.

Exports of the Polish pig sector are characterized by a fragmented geographical structure of countries to which Polish products are exported. None of the main recipients has a large share in the export value structure and the shares of the other countries account in total for approx. 37.5%. In 2016, the USA and Italy were the main recipients of chilled and frozen pork, and their shares in exports accounted for approx.

[2] О мерах по реализации Указа Президента Российской Федерации от 6 августа 2014 г. № 560 "О применении отдельных специальных экономических мер в целях обеспечения безопасности Российской Федерации".

14% and 12%, respectively. Large quantities of pork were exported also to Germany, Hong Kong, Slovakia and the Czech Republic. Pork products were exported mainly to the United Kingdom, whose share in the sector's exports amounts to approx. 6%. Germany, Denmark and Lithuania were other important recipients of Polish cold meats.

Imports of pig sector products show a strongly correlated geographical structure of countries from which pork is imported. Six EU countries accounted for approx. 92% of the value of imported products. Germany is Poland's main importing partner with a 27.5% share in the value of imports. Germany imports to Poland both chilled and frozen pork as well as live pigs. Belgium and Spain were other countries supplying significant quantities of pork to Poland, with a share in the import structure of 24% and 13%, respectively. Denmark, importing mainly live pigs, has an approx. 13% share in the import structure. Pigs are imported also from Germany and Lithuania. The Netherlands, with an approx. 9% share in imports, is another important supplier of pigs and meat to Poland. The United Kingdom imports to Poland primarily pork.

Table 7. Geographical structure of foreign trade in pig sector (2016)

Export		Import	
Country	**% share of value**	**Country**	**% share of value**
USA	13,9	Germany	27,5
Italy	12,0	Belgium	24,3
Czech Republic	9,6	Denmark	13,2
Slovakia	7,4	Spain	11,5
Germany	7,1	Holland	9,4
Hong Kong	6,5	Great Britany	6,7
Great Britany	6,0	-	
Others	37,5	Other	7,5

Source: CAAC, own calculations.

4 Consumption of pork and pork products

Meat and meat products are ones of the most important sources of protein in the diet of the Polish population, determining its proper functioning and development (Kwasek 2013). In 2016, the total meat and offal consumption amounted to approx. 76 kg per capita (in meat equivalent), of which approx. 92% was meat and meat products and 8% - offal (Popyt na zywnosc … 2017). After a profound decrease in 1992-1997, total meat consumption showed an upward trend in the following period. In 2000-2016, total meat and offal consumption increased by 15%, but there were also considerable changes in its structure. Pork consumption increased by 5% to 41 kg per capita, while poultry consumption doubled to 28 kg per capita. At the same time, a significant decline in beef consumption was recorded.

The pork consumption structure is composed of approx. 21 kg of cold meats, 16 kg of culinary meat and 4 kg of fats. The dynamic increase in poultry consumption resulted in a decrease in the share of red meat in the total meat consumption structure in the period concerned from 70% to 56%. Pork remains the basic meat type for Polish consumers.

In 2005-2016, the share of food in total household spending increased from 18.6% to 24.2%, which was due to higher food prices. The share of pork in the food spending

structure decreased from 6.7% to 5.8%. The share of cold meats in the food spending structure decreased as well - from 12.1% to 10.6%.

Table 8. Meat consumption in Poland according to balance sheet data

Year	Total meat with offals	Pork	Beef and veal	Poultry
2005	71,2	39,0	3,9	23,4
2010	73,7	42,2	2,4	24,6
2011	73,4	42,5	2,1	25,0
2012	71,0	39,2	1,6	26,1
2013	67,5	35,5	1,5	26,5
2014	73,6	39,1	1,6	28,2
2015	75,0	41,4	1,2	27,1
2016	76,0	41,0	1,3	28,5

Source: GUS, Rynek mięsa. Stan i perspektywy, nr 51, IERiGŻ-PIB, Warszwa, ARR, MRiRW, Warszawa, 2016.

Major determinants of changes in the meat consumption model in Poland included relations of prices of particular types of meat, growing polarization of income of Polish people and health considerations, in particular concerns about negative effects of cholesterol. Animal diseases like BSE, avian influenza and ASF also played a significant role in this regard. Consumers with the lowest income started buying more poultry meat, being relatively cheaper. At the same time, higher-income consumers changed their dietary preferences and substituted red meat with other protein sources (e.g. fish, cheese and curd cheese). The decline in beef consumption was mainly due to a significant increase in its price, as approx. 80% of beef production is exported.

The decreasing number of farms in which pigs are kept and the increase in farming concentration result in a gradual decrease in the share of self-subsistence in consumption. In 2015, the share of self-subsistence in pork consumption in all households was approx. 7%, of which that in farmer families – approx. 49%. In 2003, the share of self-subsistence in all households and in farmer households was approx. 18% and 78%, respectively.

There are significant differences in pork and cold meat consumption between particular household types. The largest consumption is reported in farmers' and pensioners' households. In farmer families, the average culinary pork consumption is 23 kg per capita, while that of cold meats - approx. 20 kg per capita. In pensioners' households, this proportion is opposite. The lowest consumption is reported in households of self-employed individuals: 13 kg of culinary pork and 15 kg of cold meats. Such individuals consume relatively large quantities of fish, beef and ripening cheese. In workers' families, pork consumption amounts to approx. 14 kg per capita, while cold meat consumption is 17 kg per capita.

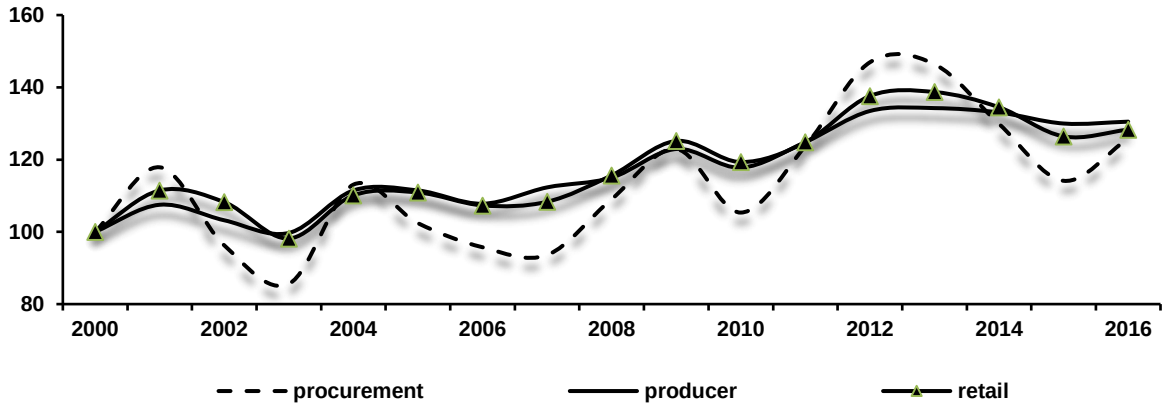
Pork and cold meat consumption shows seasonal fluctuations throughout the year. Increased demand is recorded mainly at Easter and Christmas time. At that time, the consumption increases relative to other months by approx. 25% and 40%, respectively. A seasonal increase in the consumption is observed also in summer months, which is related to preparing grilled dishes out-of-doors.

5 Price and profitability analysis

5.1 Prices in the pig sector

There are three key price categories in the marketing chain in the pig sector: pig buying-in price, selling price and retail prices of pork meat and pork products. In 2000-2016, real price indices at all stages of the marketing chain were at a similar level. Selling prices of pork and pork products increased by 30%, while retail prices increased by 28%. In the same period, prices paid for pigs to farmers increased by 26%, which attests to the farmers' poor position in the marketing chain. Statistical analysis of price indices in the marketing chain showed that the greatest volatility was recorded with respect to pig buying-in prices, which was mainly due to the cyclical nature of pork production in agriculture. The high volatility of buying-in prices resulted in lower declines in selling prices and retail prices in some periods (e.g. in 2004-2008), hence higher profits in the meat industry and retail trade.

Figure 5. Price indexes of pork



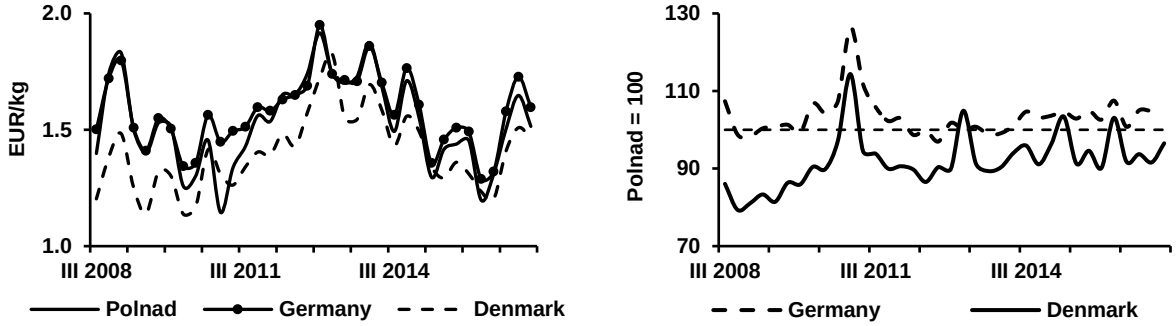
Source: GUS, own calculations.

In 2000-2016, pork retail prices increased in real terms by 28.3%. In the same period, the inflation rate was 40.9%, while food prices rose in general by 49.6%. This means that pork sector products became cheaper in real terms, also compared to food prices in general. In the period concerned, beef prices increased in real terms almost two and a half times, while poultry meat prices by only 11.1%. Poultry meat got significantly cheaper relative to pork and beef, which explains its significantly increased production and consumption. A considerable increase in retail beef prices was the main reason for a profound decrease in beef consumption. Pork got cheaper also relative to dairy products and cheeses whose retail prices increased in the period concerned by 37.1%.

Comparative analysis of quarterly pork prices demonstrated that prices paid to farmers in Poland show the same change trends and cyclical nature as prices in Denmark and Germany. This comparison clearly confirms a strong link between the domestic market and the EU market. In a long run, prices in Poland were lower than in Germany by 3% on average and higher than in Denmark by 8%. There were obviously some exceptions to this rule, but the general trends are very clear. The Polish sector is not competitive compared to the Danish one, which explains large imports of pigs from

this country. The price competitive advantage relative to the German market is small, while in the poultry market, this is by approx. 40% to the benefit of Polish producers.

Figure 6. Quarterly pig prices in Poland, Germany and Denmark



Source : European Commission, own calculations.

5.2 Profitability of pork production in farms

Profitability of pork production is determined by numerous factors which include, first and foremost, pig buying-in prices, costs of stock rotation and feed as well as the scale of production. Both pig buying-in prices and pork production show certain cyclical fluctuations. In 2000-2016, pig buying-in prices were negatively correlated with pork production. In years of high production, a noticeable decline in buying-in prices is observed, whereas when production is low, there is a downturn trend in buying-in prices.

Profitability of pork production depends not only on buying-in prices (revenue), but also on costs. As regards the total cost structure, its main items included stock rotation and feed costs, which accounted for approx. 80% of total costs (Skarzynska 2017). In 2013-2015, costs associated with stock rotation in farms surveyed by the Institute of Agricultural and Food Economics – National Research Institute accounted on average for 47%-51% of total costs, whereby in farms with a large scale of production, these costs were in the range of 53%-58%. Feed costs accounted on average for 30%-33% of total costs, whereby in the largest farms, this was approx. 27%-29%.

Due to the high significance of feed costs, profitability of pork production in farms can be assessed based on the pig buying-in price/feed grains (e.g. barley, maize) buying-in price ratio. In 2000-2016, the pig buying-in price/feed grains buying-in price ratio showed cyclical fluctuations. This was largely due to the cyclical nature of pig production and buying-in prices. In years when the pig buying-in price/feed grains buying-in price ratio is 5-7:1, production profitability declines significantly. The profitability of pork production increases when the pig buying-in price/feed grains buying-in price ratio is 8-11:1.

Surveys conducted in farms in 2013-2015 by the Institute of Agricultural and Food Economics - National Research Institute demonstrated that the production of pig livestock was unprofitable, but this calculation did not account for direct payments. Taking direct payments in this economic calculation into accounts is extremely difficult, as these payments are separated from production and linked to a farm area. The

production profitability is calculated per 100 kg of pork. Results of research performed by the Institute of Agricultural and Food Economics - National Research Institute are consistent with pig buying-in price/cereal feed buying-in price ratio. In 2013-2015, the aforementioned ratio was approx. 7.5:1 on average, hence it was slightly below the profitability threshold for pork production. Lack of profitability of production resulted in small pig livestock, large imports of pigs and relatively low pork production.

Research showed also that farms with a large scale of production (500-1,500 pigs) suffered smaller financial losses than the average losses incurred in the surveyed population, which confirms the positive impact of economies of scale on financial performance (Table 11). Large farms were given higher pig prices and incurred lower total costs. This applied to both variable cost and fixed ones, as well as amortization. In large farms, labor input (1.34 h) was much lower than the average for the population concerned (2.34 h). All these ratios confirm that large farms were more efficient, as attested to by better financial performance. Therefore, in order to make the Polish pork sector more competitive, it is necessary to enhance production concentration, which includes, in particular, establishing producer groups.

Table 9. Production, costs and revenue in pig meat production

Items	2013		2014		2015	
	average	500-1500 pigs	average	500-1500 pigs	average	500-1500 pigs
Production [dt]	418	1 508	418	1 508	418	1 508
Procurement price [PLN/kg]	5,34	5,43	4,77	4,86	4,26	4,33
	in PLN/100 kg pig meat					
Production	**534**	**543**	**477**	**486**	**426**	**433**
Variable costs:	478	494	444	461	444	470
Stock rotation	301	332	278	308	256	283
Feed	170	154	159	145	181	179
Other	7	8	7	8	7	8
Standard Gross margin	**56**	**49**	**33**	**25**	**-18**	**-37**
Fixed costs	67	44	66	45	46	43
Amortisation	40	24	40	24	41	24
Total costs	585	563	550	528	547	537
Income	**-51**	**-19**	**-73**	**-44**	**-105**	**-104**
Labour [hours]	**2,4**	**1,3**	**2,4**	**1,4**	**2,4**	**1,3**

Source: IERiGZ-PIB, system AGROKOSZTY.

6 Conclusions

The development of the pig sector in Poland is not smooth, as evidenced by a decrease in the pig livestock below 11 million heads. This has resulted in a declining share of pork in the domestic meat production, but in spite of that, the pork sector remains the key segment of the meat market, providing a primary raw material for the meat industry, which is preferred by domestic consumers.

After Poland's accession to the EU, the pig sector has not been as successful as the dairy, poultry and beef sectors. The reasons for the recession in the pig sector are many and include primarily:

- heavy fragmentation of production in agriculture and the meat industry as well as poorly developed vertical and horizontal integration,

- slow changes in the production structures and reluctance to cooperate by market players, in particular pig producers and entities processing red meat. This results in missing links in the marketing chain and limitations experienced by farmers and most processing companies,
- slow technological progress in pig production in the conditions of excessive production capacity and its poor utilization in the meat industry. This results in lower technical efficiency, high costs of production, buying-in of raw material and distribution of products,
- high price risk associated with considerable fluctuations in cereal and feed prices, resulting in sharp fluctuations in the economic viability of pig production,
- strong competition in the sector, also due to imports, which increased after Poland's accession to the EU as a result of elimination of customs barriers and lower protectionism as regards the pig market,
- the competition strategy in the meat industry is based on low prices and reducing the raw material content in final products, but it impedes, at the same time, the demand for agricultural raw materials. This restricts opportunities to develop domestic production and reduces pig producers' income. The result is low price and cost as well as quality competitiveness of Polish pork.

The high production capacity of the Polish agriculture and the unused capacity of the modernized meat industry should make Polish pork not only the key product on the domestic market, but it should also be, as it used to be until recently, exported in large quantities onto foreign markets.

Despite the increase in Polish consumers' income in 2004-2016, the increase in retail prices of meat and meat products was lower than the increase in overall food prices and the inflation rate. The real terms decline in prices of pork and pork products was mainly due to the absolute decline in poultry meat prices. Another important factor was that strategies of processing companies and traders relied primarily on price competition and reducing the meat content in final products. This suggests that the increase in consumers' income in the coming years will not be a determinant of the increase in retail prices of meat and meat products.

The analysis shows limited potential for increased consumption of raw pork, also in terms of income earned by households. This demand seems to be saturated, and some growth opportunities are offered now only by low-income families. Consumers are increasingly more interested in high-quality processed products for which they can pay more.

The comparison of prices of pig livestock in Poland and in other EU Member States confirms its low price and cost competitiveness. The price effect is enhanced by more efficient operation of slaughter companies, cutting quality and processing efficiency, compliance with quality standards, timeliness and continuity of supplies, as well as flexibility of exporters' operation. This is why Germany has a large share in imports of pork to Poland, despite higher livestock prices than in Poland.

Since 2008, a negative balance has been recorded uninterruptedly in the Polish foreign trade in pork. This is a very disturbing phenomenon, especially given the fact that this is primarily due to the low competitiveness and decreasing production of pig livestock in Poland. Imports of livestock are extremely unfavourable for pig producers. At the same time, these may be beneficial for the meat industry, as raw material whose processing may bring positive economic effects is provided. The enhanced competitive position and increased exports in the pig sector require primarily better efficiency of the production and the operation of the supply chain.

Analysis of the commodity structure of foreign trade confirmed its raw material nature. There was, however, a positive trend as regards exports, namely increased exports of processed products, which needs to be strengthened. A further increase in the share of cold meats and culinary meat in the export structure is highly desirable, as this may help increase the use of production factors, enhance the benefits of added value and enable the promotion of the sector's products on foreign markets. There is no doubt that it is easier to promote the pork sector on the market for final consumer products than by exporting half-carcasses and livestock.

Promotion of Polish meat products and cold meats on external markets requires increased engagement of operators, including sector organizations. It should focus primarily on traditional products which are clearly associated with Poland or its regions. The first positive effects of such measures are reflected in a significant number of traditional products registered in the EU.

Many years of experience in exports and familiarity with the specific characteristics of particular markets should be used to promote products that are most demanded. Products sold on the EU market (e.g. in Germany and the United Kingdom) should include primarily high-quality cold meats and culinary meat. In the eastern markets, Polish products will be bought mainly by companies from Belarus, Russia and Ukraine. As regards products sold to the Commonwealth of Independent States, these will include first and foremost sausages and meat for processing as well as offal.

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