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FINANCIAL ANALYSIS OF PRODUCERS ON THE AGRICULTURAL MARKETS IN POLAND IN THE YEARS 2004-2016

JEL codes: D24, D61, G14

Summary: The aim of the article is to examine the financial situation and efficiency of producers on the basic agricultural markets (farms), through the prism of eight financial and economic indicators such as productivity of individual production factors, level of profitability and cost-efficiency of production. The considerations were conducted for farms specializing in the production of basic agricultural products, such as: cereals and oily, root crops (including potatoes and sugar beets), fruits, vegetables under cover, beef, pork, chicken, cow's milk, chicken eggs. On the other hand, the comparison of the financial results achieved with the Hellwig's development pattern method enabled to determine which types of farms were the most effective in the post-accession period. The research used data from the Farm Accountancy Data Network. The results of the research proved that in the period after the accession to the EU (2004-2016), the financial situation and effectiveness of farms specializing in the production of poultry and eggs were in the best shape.

Key words: financial analysis, agricultural product markets, European integration.

1. INTRODUCTION

Agricultural farms within their business operations have to deal with many challenges that due to their contexts (social, environmental and economic ones) often contradict each other. In economic dimension, a basic aspect of the functioning of each market entity is its further development and providing decent income for its owners, thus it is extremely important to monitor financial situation of such market entities [Nowicka, Stankiewicz 2009, p. 11-16]. Prosperity trends in the whole economy seem especially important in meeting the above aims as well as demand and supply relations in specific branches and sectors [Czakowski, Czyżewski 2017, p. 163-178].

The aim of the article is to research the financial situation and effectiveness of agricultural farms specializing in producing some selected plant and animal products. It is worth noting that when determining effectiveness and productivity of entities functioning on a market, relative values that emphasize investment amount necessary to obtain certain aims are of special importance. In the specialist literature this research problem was often discussed by such authors as: Henryk Runowski [2008, p.7-19], Walenty Poczta and others [2009, p.40-52], Włodzimierz Rembisz [2006, p.14-30], Bazyli Czyżewski [2013, p. 101-128], Stanisław Mańko and co-authors [2008, s.5-22].

2. MATERIAL AND RESEARCH METHODOLOGY

The article presents the most important economic and financial indicators for agricultural farms contained in FADN[1] system. In the years 2004-2016 a minimum sample size of Polish FADN amounted to 12,100 farms [FADN]. For the purpose of this analysis, data in the form of arithmetic mean for selected groups of farms according to their type of conducted business activity were utilized[2]. It is worth emphasizing here that the number of groups of agricultural farms for specific production types in the following years underwent relatively small changes. The most frequently represented groups in the years in question were farms specializing in the following production types: cow milk (sample size from 1,000 to 3,000 farms), cereals and oilseeds (500-3,000), pig livestock (200-2,000), fruit (200-500) and vegetables outdoor (100-500). The number of farms in other production types such as: poultry livestock (40-200), root crops (40-100), beef cattle (15-500), hen eggs (15-100) was, on the other hand, smaller. According to the elaborations and papers quoted at the beginning as well as one's own considerations, the financial results of the agricultural farms were assessed by means of indicators calculated according to the following formulas:

- **S_1** – *economic size of a farm:* economic size (ESU) / farm,
- **W1** – *profitability of production:* income (PLN) / production value (PLN),
- **W2** – *costs of production*: total costs (PLN) / production value,
- **W3** – *productivity of land:* production value (in thousand PLN) / area of arable land (ha),

[1] FADN – Farm Accountancy Data Network.

[2] The research took into account the following data for specific types of agrcultural production (types of agricultural production quoted according to FADN classification). Cereals and oilseeds – Type 151. Specialist cereals (other than rice) oilseeds and protein crops; root crops – type 161. Specialist root crops; fruit- type 361. Specialist fruit (other than citrus, subtropical fruits or nuts); Vegetables – type 221. Specialist vegetables outdoor; Beef cattle – type 460. Specialist cattle – rearing and fattening; Pig livestock – type 513. Pig rearing and fattening combined; poultry livestock – type 522. Specialist poultry-meat, cow milk – typ 450. Specialist dairying, chicken egg – type 521. Specialist laying hens.

- **W4** – *productivity of total assets*: production value (PLN) / all assets (PLN),
- **W5** – *productivity of work*: production value (in thousand PLN) / total work performed (AWU)
- **W6** – *profitability of own work*: income (in thousand PLN) / own work (FWU),
- **W7** – *share of income subsidies*: subsidies to business activities (PLN) / income (PLN),
- **W8** – share of *investments in total assets*: net investments (PLN) / total assets (in thousand PLN).

According to the economic and financial indicators prepared for agricultural farms specializing in four types of plant production and five types of animal production, an attempt was made to determine which of these were the most effective. In order to achieve this, Hellwig's method of development pattern was used [1968, p. 307-326]. The method is often applied in the specialist literature and as an example one may quote its application by such authors as: Anna Matuszczak [2013], Iwona Pomianek [2010, p. 227-239], Monika Jaworska and Milena Rusin [2011, p. 37-46]. The procedure applied in that method assumes standardization of variables, which was carried out according to the formula below:

$$z_{ij} = \frac{x_{ij} - \overline{x}_j}{S_j}, \qquad \begin{matrix} i = 1, 2, \ldots, n \\ j = 1, 2, \ldots, n \end{matrix}$$

where:
z_{ij} – standardized values of j feature for i object,
x_{ij} – values of j feature for i object
$\overline{x}_{ij}$ – arithmetic mean of j feature,
s_j – standard deviation of j feature.

According to matrix of normalized values of features, a pattern method was applied assuming the existence of abstract ideal object (z_{oj}), of coordinates determined separately for features being stimulants and destimulants in accordance with the below procedures: z_{oj} = max of z_{ij}, when z_{ij} is a stimulant, z_{oj}= min of $z_{ij,}$ when z_{ij} is a destimulant. In the next step of this method, distances of each object in question from the abstract pattern were determined according to the formula below:

$$d_{io} = \sqrt{\sum_{j=1}^{m} (z_{ij} - z_{oj})^2}$$

where: d_{10} – Euclids' distance of object z_{ij} from the pattern object z_{oj}

The last stage of conducted research procedure consisted in calculating the synthetic development meter. The created meters take the values from the bracket

of [0;1]. The meter's value closer to one for a specific object means that it is closer to the pattern that contains the set of the most desirable features [Bąk 2016, p. 26-27]:

$$d_i = 1 - \frac{d_{io}}{d_o}; \quad d_o = \bar{d}_o + 2S_d; \quad \bar{d}_o = \frac{1}{n}\sum_{i=1}^{n} d_{io}; \quad S_d = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(d_{ij} - \bar{d}_o\right)^2}$$

where:
d_1 – synthetic development meter (measure of development),
d_0 – Euclid's distance of object z_{ij} from pattern object z_{oj},
$\bar{d}_0$ – arithmetic mean of taxonomic distances,
s_d – standard deviation of taxonomic distances.

3. RESEARCH RESULTS

Table 1 contains mean year values (for years 2004-2016) of the created economic and financial indicators for farms specializing in specific types of production and their dynamic for the years between 2004 and 2016. From the group of examined agricultural producers, the highest costs of production (W2) and the lowest indicators of the productivity of assets (W4) and work (W5) was exhibited by farms of the lowest economic value (S1). These included mainly entities dealing with production of fruit, cereals and oilseeds as well as rearing cattle for slaughter or milk. It was a logical conclusion as small producers to a lesser degree experience benefit of scale. Due to relatively low costs of work, igh work input in production was not an obstacle in achieving such income and being able to compete with foreign producers with considerably higher level of capital input [Czakowski 2017, p.161-180]. Such situation should remain as long as comparative advantages can be found in Poland connected with availability of cheaper labour force than in the countries of Western Europe. Moreover, in spite of the lowest value of indicators concerning productivity of land and capital on the market of cereals and oilseeds, this sector is characterized by a similar indicator of profitability of production (W1) as regards root crops and outdoor vegetables. The above situation has found its simple justification in shaping value of the share of income subsidies indicator (W7). On average, in the whole period after joining EU by Poland, subsidies have accounted for as much as 94% of the income value for farms specializing in the production of cereals and oilseeds. At the other end of the spectrum, there are farms of producers of vegetables under cover, where subsidies have covered on average of only 21% of obtained income. These statistics justify a similar indicator of profitability on the market of vegetables despite more beneficial indicator of production costs and larger economic size.

Among the farms functioning on the market of animal products in the conducted research, the highest indicators of profitability (W1) were achieved,

Table 1. Selected economic and financial indicators for farms covered by the FADN system in Poland, specializing in selected plant and animal production

Specification	Cereals and oilseeds		Root Crops		Fruit		Vegetables Outdoor	
	2004-2016a	2016/2004b	2004-2016a	2016/2004b	2004-2016a	2016/2004b	2004-2016a	2016/2004b
S1	23,78	100,90	29,85	171,49	15,15	162,83	27,36	354,35
W1	0,36	65,6	0,37	94,0	0,31	122,8	0,39	118,70
W2	0,93	128,1	0,74	106,2	0,77	110,2	0,69	105,37
W3	3,38	111,5	8,24	158,0	13,00	78,5	13,28	85,70
W4	0,20	38,5	0,29	42,4	0,18	72,8	0,32	56,33
W5	97,47	62,4	90,03	78,3	51,91	104,3	62,20	117,44
W6	42,12	38,1	41,65	75,8	25,57	116,6	46,13	112,75
W7	0,94	201,3	0,35	108,7	0,30	262,9	0,21	230,73
W8	9,27	-101,1	14,07	-7,2	-9,42	-77,7	6,71	-28,86

Specification	Beef cattle		Pig livestock		Poultry livestock		Cow milk		Chicken eggs	
	2004-2016a	2016/2004b	2004-2016a	2016/2004b	2004-2016a	2016/2004b	2004-2016a	2016/2004b	2004-2016a	2016/2004b
S1	16,34	109,9	54,76	370,71	174,74	102,5	28,65	188,3	279,85	106,2
W1	0,41	157,3	0,26	83,20	0,17	81,2	0,42	100,4	0,21	221,7
W2	1,06	124,0	0,85	107,50	0,85	102,5	0,76	117,5	0,81	84,7
W3	2,60	72,1	10,72	161,62	73,27	72,3	6,32	100,5	72,75	49,4
W4	0,11	40,9	0,31	87,21	0,88	83,1	0,19	57,4	0,70	90,3
W5	35,15	88,4	145,23	258,67	524,65	76,8	70,47	137,0	289,49	93,1
W6	14,68	139,8	41,88	264,00	177,41	70,5	30,56	136,1	143,83	201,8
W7	1,25	168,3	0,41	115,54	0,10	316,9	0,44	195,1	0,09	157,6
W8	-3,95	-39,2	-0,20	127,12	7,48	-542,8	9,84	-65,6	-19,79	98,2

W1 – profitability of production, W2 – cost of production, W3 – productivity of land, W4 – productivity of total assets, W5 – productivity of work, W6 – profitability of own work, W7 – share of income subsidies, W8 – share of investments in total assets; [a] The arithmetic mean of years; [b] index of dynamics between indicated years, 2004=100.

Source: calculations based on: FADN, http://ec.europa.eu/agriculture/rica/database/ [18.05.2018].

similarly to the market of plant products, by farms that exhibited the largest share of subsidies in relation to profit gained on operational business activities (W7). The above situation concerned mainly breeders of beef cattle and pig livestock as well as cow milk producers. The relation between the subsidies and income for the farms specializing in beef cattle rearing in the period in question amounted to 1.25 on average. Hypothetically, after deducting the amount of subsidies it might turn out that such farms did not produce any profit at all. In contrast, the lowest relation between subsidies and income characterized agricultural producers on the poultry and egg market. It certainly determined

profitability indicators that for farms having poultry for slaughter and laying hens were lower than for other examined farms. However, due to considerably larger economic size of poultry and egg producers than other farms they functioned obtaining lower profits per unit. A feature that testified clearly to the very good organization of such farms was the productivity of capital (W4). In the case of poultry meat producers, an average relation between the production value to the held assets in total amounted to 0.88, whereas for farms producing chicken eggs – 0.7. These results were much different than the results achieved by other farms functioning both on the market of animal and plant products. At the same time, the results proved that the farms from the poultry sector were characterized by the highest specialization and production concentration, which was also confirmed by shaping of the productivity of work indicators (W5) as well as productivity of one's own work (W6).

Within the group of eight selected economic and financial indicators describing economic effectiveness of agricultural farms functioning on markets of specific agricultural products, six performed the function of stimulants. They included such indicators as: W1 – profitability of production, W3 – productivity of land, W4 – productivity of total assets, W5 – productivity of work, W6 – profitability of one's own work, W8 – share of investments in total assets. The other two variables: W2 – costs of production and W7 – share of income subsidies were destimulants for the shaping of synthetic economic effectiveness meter. Share of income subsidies was classified to the group of indicators negatively influencing effectiveness due to their extra-market character and obtained values by that feature. The above research procedure was carried out for all farms specializing in specific types of production.

The achieved results clearly indicated that the farms specializing in the production of poultry meat and chicken eggs were closest to the established pattern (table 2). High economic effectiveness of poultry farms was not surpising as poultry and egg market in the period after Poland joined the EU has presented very high level of competitveness, which has translated into very dynamic increase of export in that period [Czakowski 2015, p. 22-23]. The success of poultry producers in Poland was the outcome of well thought out investments and performed concentration operations that resulted in their transformation from small-scale agricultural farms into highly specialized farms of industrial character.

The following places in the ranking showing distance from the pattern were occupied mainly by producers of root crops, cow milk and outdoor vegetables. Farms of these three agricultural types have achieved a similar mean development meter in the period after Poland joined EU. It is worth noting that from among the examined agricultural entities, definitely largest economic size was exhibited by farms specializing in animal production, mostly poultry, eggs and pig livestock producers, which was not reflected in the higher position in the ranking of the last ones. Pig producers were less effective than vegetable, root crops and milk producers although they were roughly twice as big as the

Table 2. Effectiveness of farms specializing in particular types of agricultural production in Poland in 2004-2016

Specification		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2004- 2016[a]
Cereals and oilseeds	P	0,30	0,18	0,19	0,37	0,36	0,27	0,36	0,28	0,43	0,19	0,29	0,29	0,18	0,29
	W	6	9	8	7	6	7	7	8	3	8	7	8	9	8
Root Crops	P	0,50	0,35	0,62	0,42	0,36	0,45	0,45	0,34	0,37	0,47	0,36	0,49	0,44	0,48
	W	2	5	2	5	5	5	4	7	5	3	6	4	5	4
Fruit	P	0,25	0,35	0,36	0,41	0,27	0,19	0,34	0,44	0,33	0,32	0,17	0,43	0,28	0,31
	W	8	6	6	6	8	8	8	3	8	7	9	5	7	7
Vegetables Outdoor	P	0,43	0,53	0,51	0,45	0,55	0,47	0,57	0,36	0,40	0,45	0,47	0,54	0,47	0,51
	W	3	3	3	2	3	4	3	5	4	4	3	3	3	3
Beef cattle	P	0,08	0,21	0,16	0,20	0,12	0,16	0,11	0,07	0,05	0,10	0,21	0,17	0,21	0,11
	W	9	8	9	8	9	9	9	9	9	9	8	9	8	9
Pig livestock	P	0,28	0,34	0,30	0,17	0,28	0,47	0,40	0,35	0,36	0,37	0,38	0,34	0,46	0,34
	W	7	7	7	9	7	3	6	6	6	5	5	7	4	6
Poultry livestock	P	0,65	0,77	0,70	0,79	0,65	0,77	0,83	0,67	0,63	0,66	0,85	0,82	0,76	0,78
	W	1	1	1	1	2	1	1	1	1	1	1	1	1	1
Cow milk	P	0,35	0,51	0,41	0,42	0,42	0,35	0,43	0,42	0,35	0,36	0,47	0,40	0,38	0,44
	W	5	4	5	4	4	6	5	4	7	6	4	6	6	5
Chicken eggs	P	0,43	0,60	0,50	0,44	0,70	0,61	0,67	0,55	0,63	0,48	0,52	0,70	0,67	0,58
	W	4	2	4	3	1	2	2	2	2	2	2	2	2	2

P – ranking position; W – value of the synthetic development meter; [a] *The arithmetic mean of years.*
Source: calculations based on: FADN, http://ec.europa.eu/agriculture/rica/database/ [18.05.2018].

former as regards their economic size. It is justifiable to think that in the case of farms breeding pigs the decisive factor that influenced their results was lower profitability and higher costs of production. Farms dealing with fruit were placed relatively low in the ranking, which certainly resulted from their lowest (alongside beef producers) economic size and low productivity of work and capital [Czyżewski and others 2018, p. 265-277]. In turn, two last places in the ranking of the distance from the pattern, were occupied by farms of producers of cereals, oilseeds and beef cattle. The farms on both above mentioned markets in the period in question showed the highest share of EU subsidies in their income. Considerable amount of subsidies as experienced by them was accompanied by a high level of costs of production but due to the considerable granted subsidies they managed to remain profitable.

4. SUMMARY

One may claim that in the first decade after Poland's joining EU structures, effectiveness relations measured with the use of elaborated indicators presented farms specializing in poultry and egg production in most beneficial way. It was congruent with good economic trend of that sector in Poland and its competitive international position [Czyżewski, Czakowski 2017, p.265-277]. Producers of beef cattle, cereals and oilseeds presented also very interesting financial and economic results. It turned out that on these both markets, agricultural farms were characterized by relative low productivity of productive factors (with the exception of the work factor for farms producing cereals and oilseeds) and despite that achieved positive coefficients of production profitability. In the case of these two markets, relative low costs of work and considerable financial support had vital importance for shaping their agricultural profits.

BIBLIOGRAPHY

- Bąk A., 2016, *Porządkowanie liniowe obiektów metodą Hellwiga i TOPSIS – analiza porównawcza*, „Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu" nr 426, s. 22-31.
- Czakowski D., 2015, *Zasobowe i efektywnościowe uwarunkowania produkcji drobiu i jaj w Polsce z perspektywy akcesji do Unii Europejskie*, „Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu" t. XVII, z. 2, s. 20-25.
- Czakowski D., 2017*, Konkurencyjność międzynarodowa podstawowych produktów rolnych w Polsce przed i po akcesji do Unii Europejskiej (1994-2013),* „Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy" no 10, s. 161-180.
- Czakowski D., Czyżewski A., 2017, *Podstawowe rynki rolne w Polsce przed i po akcesji do Unii Europejskiej. Poziom i uwarunkowania rozwoju*, Wyd. KPSW, Bydgoszcz, s. 163-178.

- Czyżewski A., Bieniek-Majka M., Czakowski D., 2018, *Factors shaping supplydemand relations on the fruit and vegetable market in the light of the behavior of groups and producer organizations,* "Management" 22(1), s. 265-277.
- Czyżewski A., Czakowski D., 2017, *Changes in Agricultural Markets in Poland following its Accession to the European Union*, "Management" 21(2), s. 138-150.
- Czyżewski B., 2013, *Renty ekonomiczne w gospodarce żywnościowej w Polsce,* Polskie Wydawnictwo Ekonomiczne, Warszawa, s. 101-128.
- FADN, http://ec.europa.eu/agriculture/rica/database/ [18.05.2018].
- Hellwig Z., 1968, *Zastosowanie metody taksonomicznej do typologicznego podziału krajów ze względu na poziom ich rozwoju oraz zasoby i strukturę wykwalifikowanych kadr,* „Przegląd statystyczny" no 4, s. 307-326.
- Jaworska M., Rusin M., 2011, *Zróżnicowanie stanu środowiska naturalnego w Polsce*, „Journal of Agribusiness and Rural Development" nr 1 (19), s. 37-46.
- Mańko S., Sobczyński T., Sass R., 2008, *Zmiany poziomu zrównoważenia płynności finansowej w gospodarstwach rolniczych UE w latach 1989-2005,* „Zeszyty Naukowe SGGW. Ekonomika i Organizacja Gospodarki Żywnościowej" nr 64, s. 5-22.
- Matuszczak, A., 2013, *Zróżnicowanie rozwoju rolnictwa w regionach Unii Europejskiej w aspekcie jego zrównoważenia,* PWN, Warszawa.
- Nowicka S., Stankiewicz J., 2009, *Analiza i ocena kondycji finansowej na przykładzie wybranych spółek*, TNOiK, Toruń, s.11-16.
- Poczta W., Czubak W., Pawlak K., 2009, *Zmiany w woluminie produkcji i dochodach rolniczych w warunkach akcesji Polski do UE*, „Zagadnienia ekonomiki rolnej" no 4, s. 40-52.
- Pomianek I., 2010, *Poziom rozwoju społeczno-gospodarczego obszarów wiejskich województwa warmińsko-mazurskiego,* „Acta Scientiarum Polonorum. Oeconomia" t. 9, no 3, s. 227-239.
- Rembisz W., 2006, *Endogenne i egzogenne warunki wzrostu dochodów producentów rolnych,* „Zagadnienia Ekonomiki Rolnej" no 2, s. 14-30.
- Runowski H., 2008, *Wykorzystanie bilansu majątkowego w ocenie stanu i kierunków zmian sytuacji ekonomiczno-finansowej przedsiębiorstw hodowlanych*, „Roczniki Nauk Rolniczych" seria G, t. 95, z. 2, s. 7-19.

ANALIZA FINANSOWA PRODUCENTÓW NA RYNKACH ROLNYCH W POLSCE W LATACH 2004-2016

Streszczenie: Cel artykułu stanowi zbadanie sytuacji finansowej i efektywności producentów na podstawowych rynkach rolnych (gospodarstw rolnych), przez pryzmat ośmiu wskaźników finansowo-ekonomicznych takich jak m.in. produktywność poszczególnych czynników wytwórczych, poziom rentowności oraz kosztochłonności produkcji. Rozważania przeprowadzono dla gospodarstw rolnych specjalizujących się w produkcji podstawowych produktów rolnych, takich jak: zboża i rośliny oleiste, rośliny okopowe (w tym ziemniaki i buraki cukrowe), owoce, warzywa gruntowe, żywiec wołowy, wieprzowy oraz drobiowy, mleko krowie, jaja kurze. Z kolei porównanie osiąganych wyników finansowych metodą wzorca rozwoju Hellwiga umożliwiło określenie, które typy gospodarstw rolnych były najbardziej efektywne w okresie poakcesyjnym. W badaniach wykorzystano dane z Sieci Danych Rachunkowych

z Gospodarstw Rolnych (ang. Farm Accountancy Data Network). Wyniki badań dowiodły, iż w okresie po akcesji do UE (2004-2016) najkorzystniej kształtowała się sytuacja finansowa oraz efektywność gospodarstw specjalizujących się w produkcji drobiu i jaj.

Słowa kluczowe: analiza finansowa, rynki produktów rolnych, integracja europejska.

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