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Efficiency of Polish organic and conventional farms

The main objective of this study is to compare the efficiencies of organic and conventional farms in Poland. As shown by the conducted analysis, acting in compliance with the essential production principles, organic farms practiced extensive farming which resulted in reduced efficiency of productive inputs. The efficiency of land and labour measured by the Adjusted Net Value Added was respectively nearly 30 and 65 per cent higher in conventional holdings. Moreover, subsidies contribute more to the income of organic farms, making them strongly dependent on external support (this is especially true for farms with grazing livestock). As a part of policy planning, it should be taken into consideration that organic farms may in the future encounter a development barrier stemming from lower efficiency, difficult access to subsidies and, finally, lower levels of income.

Keywords: profitability, factors of production, producers' support, FADN

JEL classifications: D24, O13, Q12

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Introduction

Farmers face multiple challenges posed by the need to meet economic, ethical and environmental standards at the same time. Various degrees of compliance with these standards are enabled by specific agricultural production systems. While some production systems ensure a more efficient pursuit of economic goals, others contribute more to environmental and ethical objectives. Organic farming and conventional farming are two extremely different production systems in terms of their reliance on industrial productive inputs and environmental impacts. In highly developed countries, conventional farming is based on the use of agrochemicals and intensive production methods, and demonstrates several characteristics which include: low use of labour in agricultural production; high productivity of labour; concentration of land and production. In turn, organic farming is a highly restrictive system from the environmental protection perspective (Pimentel *et al*., 2005, Lampkin and Stolze, 2009, Dévényi, 2011). According to Council Regulation (EC) No. 834/2007[1], organic production is an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes. This is reflected by the total prohibition on productive inputs of industrial origin (e.g. mineral fertilisers, pesticides and synthetic feed additives). The use of antibiotics, growth stimulants and veterinary medicines is also prohibited[2].

As emphasised by Runowski (2009), the two farming systems differ by the efficiency of pursuing economic and environmental objectives. The use of extensive production methods, high labour intensity and low capital intensity of organic farming make it less efficient than conventional farming; this translates into lower effectiveness of providing private production effects. This observation was made by many authors, including Tamaki *et al*. (2002), Pimentel *et al*. (2005), Badgley *et al*. (2007), Tomek de Ponti *et al*. (2012) and, as regards Polish agriculture, Runowski (2004, 2009), Łuczka-Bakuła (2011, 2013) and Gołaś (2017). Conversely, conventional farming has a stronger environmental impact and is therefore less effective in the pursuit of environmental objectives. However, it should be noted that both systems provide an opportunity to serve the environmental goals better (environmental goods). Similarly, neither conventional nor organic farming has yet made full use of its production capacities (private goods).

In a broader context, the functioning of conventional farming enables food self-sufficiency, effective use of productive inputs, and improving the agricultural population's standards of living by increasing the individual incomes of agricultural producers (through the increase of labour productivity and production efficiency). As long as agriculture does not provide enough foodstuffs corresponding to the population's consumption level, these objectives are also consistent with the expectations of consumers who demand cheap, standard food. As a consequence of agricultural development, consumer demand becomes gradually satisfied in quantitative terms. At the same time, the growth of consumer welfare is accompanied by a shift in the nature of demand: there is growing demand for high-quality products which include organic food. This is a part of the evolution taking place in today's consumption patterns. Factors affecting the decision to purchase organic products primarily include healthcare; the population's income level; and care for the natural environment and animal welfare (Dimitri and Dettmann, 2012; Ozguven, 2012; Shafie and Rennie, 2012). However, according to Łuczka-Bakuła (2011), the demand for organic foods emerges as an economic and social pro-

[1] Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.

[2] The classification of main production systems provided in the relevant literature also includes integrated farming as an intermediate form between conventional and organic farming. According to the International Organization for Biological and Integrated Control: Integrated production/farming is a farming system that produces high quality food and other products by using natural resources and regulating mechanisms to replace polluting inputs and to secure sustainable farming. Emphasis is placed on: 1) a holistic systems approach involving the entire farm as the basic unit, 2) the central role of agro-ecosystems, 3) balanced nutrient cycles, and 4) the welfare of all species in animal husbandry (Boller *et al*., 2004).

cess only if high incomes are accompanied by environmental awareness of the consumers.

Based on the wide literature, it could be concluded that, in addition to natural potential, the development of organic agriculture strongly depends on economic factors, mainly including demand, prices of organic products and the level of producers' support. Factors influencing the economic performance include also the effective use of productive inputs. This purpose of this paper is an attempt to answer the question on the scale of differences in the efficiency of productive inputs and profitability of Polish organic and conventional farms. These issues are presented against the background of development trends of organic farming in Poland.

Organic farming in Poland

The beginnings of organic farming in Poland date back to the 1920s. However, a stronger growth has been experienced only since 1998, driven by the introduction of subsidies towards farm inspection costs and, in 1999, direct payments towards organic agricultural land. Meanwhile, until 2002, the absence of countrywide inspection systems that would allow to orchestrate the market, improve exports and protect the consumers was a barrier to the development of organic farming in Poland. Key changes in this area were triggered by Poland's accession to the European Union (EU). On the one hand, this enabled the producers to access higher payments towards organic agricultural land while, on the other, it provided more opportunities for the growth of demand for organic products they offer (Kowalska, 2010).

There was a considerable growth of organic farming in Poland in the period 2004-2016. The numbers of both organic farms and organic food processing enterprises increased. The total number of organic producers in that period increased more than six-fold. In 2016, there were 23,400 organic producers; they cultivated 536,600 ha of land which means a 3.7 per cent share in the total utilised agricultural area (UAA, Table 1). According to Eurostat data[3], in the EU-28 Member States, the average share of the organic sector in the total UAA was 6.2 per cent, with the highest levels being recorded in Austria (19.1 per cent), Sweden (15.4 per cent) and Estonia (13.3 per cent). In turn, as regards countries similar to Poland in terms of agricultural production structure (due to climate conditions), such as Germany and France, the share of organically-farmed land in the total UAA was 6.3 and 4.7 per cent respectively. Despite the overall growth in the organic farming sector, the area of organic land decreased from 2014. This may result from several reasons. Firstly, as shown by the statistics, the largest decline in organically-farmed area was recorded in farms producing permanent crops. Usually, these farms were poorly linked to the market and considered the EU subsidies to be a form of rent. For them, the expiry of five-year commitments (under the 2007-2013 EU Rural Development Programme (RDP), agreements were entered into for a five-year term) meant the end of organic farming. This may be illustrated by the example of walnut tree growers in Zachodniopomorskie Voivodeship where the largest decline in the number of organic farms was reported[4]. The second important reason behind the declining interest of producers in organic farming is the growing bureaucracy involved in documenting and controlling their activities. This is especially true for small holdings (in particular, animal farms) where organic production is an ancillary activity to agriculture, their main source of income. Also, the multitude of regulations and principles, the documentation that needs to be kept, and the control mechanisms require extensive know-how. The difficulties in hiring people willing to work in agriculture are another reason, having in mind that organic farming is more labour-intensive, as mentioned earlier in this paper. Undoubtedly, the reasons also include poor quality soils used by Polish farmers.

Table 1: Organic utilised agricultural area and farms in Poland, 2000-2016.

Year	Utilised agricultural area (thousand ha)		Number of organic farms	Share of organic farms in total farms
	Organic[1]	Total		(%)
2000	11.7	17,812	949	0.05
2001	44.9	17,611	1,778	0.06
2002	53.5	16,899	1,977	0.07
2003	61.2	16,169	2,286	0.08
2004	104.9	16,327	3,760	0.13
2005	166.3	15,906	7,182	0.26
2006	228.0	15,957	9,194	0.35
2007	288.3	16,177	12,121	0.46
2008	314.9	16 154	15,206	0.58
2009	416.3	16,119	17,423	0.68
2010	519.1	14,860	20,956	1.36
2011	605.5	15,134	23,847	1.42
2012	661.7	14,969	26,376	1.76
2013	670.0	14,609	27,093	1.86
2014	657.9	14,558	25,427	1.76
2015	580.7	14,545	23,015	1.63
2016	536.6	14,515	23,375	1.66

Note:[1]UAA in and after conversion
Source: IJHARS (2015)

Methodology

The study relies on data collected in the Polish Farm Accountancy Data Network (FADN; http://fadn.pl), grouped by agriculture types and economic size classes. The survey sample covered 357 organic farms and 12,330 conventional farms. Conventional farms form a statistically-representative sample for the field of observation of

[3] http://ec.europa.eu/eurostat/web/agriculture/data/database

[4] Under the 2004-2006 RDP, one of the highest rates of subsides for the cultivation of fruit species was allocated to walnut tree growers. Throughout the support period, they were not required to report yields, and therefore a large amount of funds was absorbed by owners of low-cost orchards. As a consequence, lower payments were allocated to this type of cultivation under the 2007-2013 RDP. In turn, because of poor interest in vegetable crops (as shown by their negligible share in the structure of aid disbursed), the dedicated payments were increased (IJHARS, 2015).

Polish FADN, extending to 730,861 commercial farms in Poland in 2014. As regards organic farms, the data are not statistically representative, and therefore cannot be interpreted as the situation of the entire group of Polish organic farms. However, the FADN database is the largest and most comprehensive source of data on organic farms so far, enabling the analysis of their economic situation. The comparative analysis used average levels of indicators for specific farm groups selected by type and economic size class. In accordance with FADN data dissemination principles, the results for types or classes composed of fewer than 15 farms are not published. This condition was met for three types of organic farms: horticultural crops, pigs and poultry, and for two size classes of farms: large and very large holdings. Therefore, they were omitted in the Tables prepared for both organic farms and conventional farms. The basis for calculating the efficiency indicators of productive inputs was assumed to be the net value added adjusted with operating activity subsidies as per the following formula:

Gross farm income (SE410) – Depreciation (SE360) = Farm net value added (SE415) – Total subsidies excluding on investment (SE605) = Adjusted net value added (ANVA)

According to Goraj and Mańko (2011), this procedure enables a more extensive assessment of the situation of farms covered by financial support (included in the calculation at the gross value added stage). Thus, the efficiency measures of productive inputs were as follows:

Land efficiency = ANVA / Utilised agricultural area (SE025)

Labour efficiency = ANVA / Total labour input (SE010)

Capital efficiency = ANVA * 100 / Total assets (SE436)

The farmer, as an entrepreneur, places importance on farming incomes as they compensate for own work. According to the FADN methodology, the family farm income includes operating activity subsidies.

Results

In accordance with the classification by agriculture type, both in the organic farms group and in the conventional farms group, farms engaged in mixed production represented around one third of the total population in 2014 (Figure 1). Ranked next (21 and 27 per cent for organic and conventional farms respectively) were field crops farms. Dairy cows and other grazing livestock organic farms types had comparable shares. As regards conventional farms, the importance of the latter type was lower (3.8 per cent compared to 20.4 per cent for organic farms).

When analysed by economic size class, small farms had the largest share (57.7 per cent) in the organic farm group, followed by medium-small and very small ones (Figure 2). Together, these two farm classes accounted for nearly 92 per cent of all organic farms covered by FADN. This structure differed from that of conventional farms, especially as regards the share of the farms classed as large and very large. Together, they accounted for 10.5 per cent of all conventional farms, compared to only 2 per cent of organic farms. At the same time, it should be emphasised that, in the structure of Polish conventional holdings, small and medium-small farms (with a share of 64 per cent of all farms) are by far more numerous than in Western European countries.

As regards efficiency indicators, for organic farms the average levels of all indicators were lower than for conventional farms. On average, land efficiency and total labour efficiency of organic farms were just 64.7 and 31.8 per cent respectively of the efficiency of conventional farms. This results from the greater amounts of human labour involved in organic production with many time-consuming manual tasks. Their crop technologies are less dependent on physical capital; this requires a greater number of employees, especially seasonal workers. The smallest differences between organic and conventional farms exist as regards capital efficiency measured as adjusted net value added per PLN 100 of total assets. At PLN 2.3 for organic farms, the value is 82.1 per cent of that of conventional farms (PLN 2.8). This may be related to lower levels of expenditure in organic farms; at

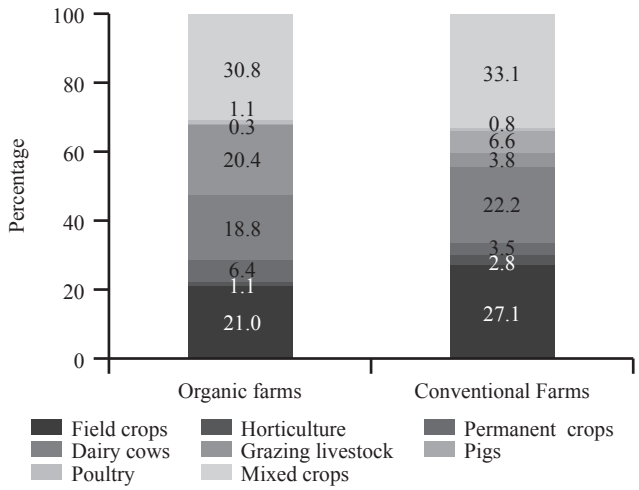

Figure 1: Structure of organic and conventional farms by type, 2014.

Data source: Polish FADN

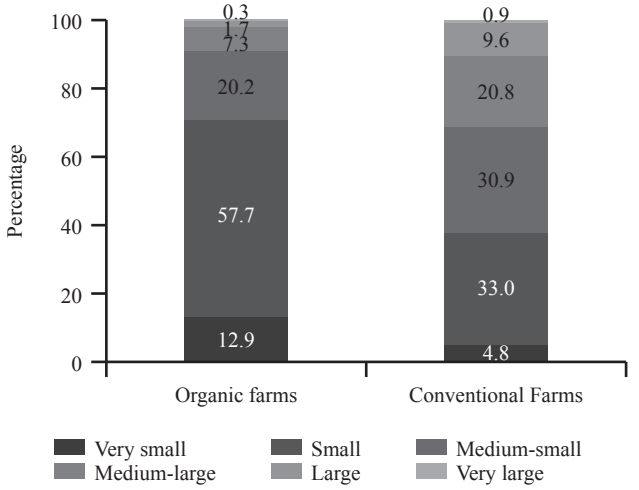

Figure 2: Structure of organic and conventional farms by economic size class, 2014.

Data source: Polish FADN

the same time, it could possibly be explained by the law of diminishing marginal efficiency of expenditure in conventional farms.

Based on the analysis of specific farm types (Table 2), it may be concluded that the largest differences in the efficiency of land and labour between organic farms and conventional farms were experienced for dairy cow farms. The efficiency of the above productive inputs was about 60 per cent lower for organic farms. Meanwhile, it should be noted that, as regards both organic farms and conventional farms, dairy cow holdings had the highest land efficiency and one of the highest levels of labour efficiency. In Poland, owing to favourable climate conditions, the cattle grazing period is nearly six months, which is conducive to cheap, high-quality production. Also, organic farms demonstrate a distinctively large share of permanent pasture which provides favourable conditions for organic milk production (Gołaś, 2017). Specific attention should be paid to two types of organic farms (grazing livestock and mixed production) which reported negative efficiency indicators after removing the operating activity subsidies from farm net value added. This is demonstrated by the fact that for these types of farms, production efficiency (and the related profitability) was mainly determined by subsidies.

Considering the clustering of farms by economic size class, it may be concluded that among organic farms the highest land efficiency was reported by very small holdings (Table 3). Moreover, in these holdings, the efficiency of productive inputs was higher than for conventional farms. This may result from the fact that the group of very small farms included high-density, highly productive poultry and horticulture farms. In turn, as regards conventional farms, the capital efficiency ratio of very small farms was negative. The productive input efficiency indicators increased in line with the economic size of conventional farms. According to Średzińska (2017), this confirms the common belief that the increase in production scale favourably affects production efficiency and, consequently, financial performance. This is demonstrated by the ratio of family farm income per family work unit (FWU). At the same time, as the economic size of conventional farms grows, the share of subsidies in incomes declines. Although the level of subsidies was increasing, this was determined by the size of the production potential expressed as UAA eligible for payments. A similar situation took place in the group of organic farms; however, in each farm class, the levels of family farm income and subsidies were above the corresponding figures for conventional farms. The biggest (more than double) differences in incomes and subsidies were recorded in very small holdings; and in medium-small and medium-large holdings respectively.

When it comes to the classification by agriculture type, in organic farms the highest average family farm income per FWU was reported by holdings specialising in field crops, followed by those specialising in permanent crops. This means organic farms outperformed the corresponding types of conventional holdings nearly four times (permanent crops) and twice (field crops). In turn, in the conventional farms group, the highest family farm income per FWU was earned by dairy cow holdings. Undoubtedly, the contributing factors were, on one hand, the highest efficiency of productive inputs and, on the other, one of the highest levels of operating activity subsidies. Nevertheless, conventional dairy cow farms had the lowest share (42 per cent) of subsidies in their incomes. It was similar for that type in the organic farms group; however, the corresponding share was higher (74 per cent).

As indicated by the above figures, the impact of funds disbursed under the Common Agricultural Policy (CAP) on the functioning and incomes of farms is much stronger in the organic farms group than in the conventional farms group. The subsidies often compensate for losses caused by lower efficiencies when shifting to organic farming. However, as emphasised by Łuczka-Bakuła (2013), because of high per-hectare subsides, many farmers employ only the minimum extent of organic production principles in order to access funds. Furthermore, many beneficiaries of payments establish fake organic farms which are not aligned with market expectations.

Table 2: Efficiency of organic and conventional farms by type of farm, 2014.

Specification	Field crops	Permanent crops	Dairy cows	Grazing livestock	Mixed
Conventional farms					
Land efficiency (PLN/ha)	516	1,125	1,442	363	331
Labour efficiency (PLN/AWU)	12,436	6,101	21,384	5,343	4,469
Capital efficiency (PLN/PLN 100 total assets)	2.3	1.8	4.2	1.2	1.3
Family farm income per FWU (SE430) (PLN/FWU)	29,970	12,684	34,401	15,136	14,142
Total subsidies, excluding on investment (SE605) (PLN)	37,887	19,455	25,392	25,460	21,769
Share of total subsidies in family farm income (%)	86	113	42	120	101
Organic farms					
Land efficiency (PLN/ha)	422	385	621	-265	-327
Labour efficiency (PLN/AWU)	10,928	6,628	8,563	-7,064	-4,233
Capital efficiency (PLN/PLN 100 total assets)	2.1	1.5	2.2	-1.1	-1.2
Family farm income per FWU (SE430) (PLN/FWU)	58,187	48,452	27,771	28,229	23,537
Total subsidies, excluding on investment (SE605) (PLN)	72,515	58,541	36,715	60,150	36,524
Share of total subsidies in family farm income (%)	90	109	74	136	99

Note: EUR 1 = PLN 4.3
Data source: Polish FADN

Discussion and conclusions

The purpose of this paper was to identify the scale of differences in the efficiency of productive inputs and profitability of Polish organic and conventional farms. Because of different assumptions underpinning both farming systems, it may be concluded that rather than competing with each other, they are mutually complementary. Conventional farming is focused on mass production with the use of a production technology based on the consumption of large amounts of industrial productive inputs, resulting in high vegetable and livestock productivity. The overarching objective of this production type is to maximise profits. Often, this is accompanied by adverse environmental impacts. Conversely, the basic objective of organic farming is to make high-quality products while caring for the environment. In the Council Regulation No. 834/2007, the European Commission emphasises that the organic production method thus plays a dual societal role, where it on the one hand provides for a specific market responding to a consumer demand for organic products, and on the other hand delivers public goods contributing to the protection of the environment and animal welfare, as well as to rural development. However, what also matters from the producer's point of view is the economic effect whose determinants include production efficiency. As suggested by the calculated efficiency indicators of productive inputs, conventional farms have a greater average efficiency than organic farms. The lower economic performance is the consequence of lower technical efficiency. According to Offermann and Nieberg (2000), organic farm yields are on average 20-30 per cent lower than conventional farm yields. This is also true for milk and meat production. For instance, based on FADN data, Gołaś (2017) indicates that cow milk yield in Polish conventional farms was on average more than 50 per cent higher. In a sense, the lower efficiency of organic farms is a natural consequence of extensive productive methods and rigorous rules for certified crops and livestock breeding, especially including the total prohibition of synthetic fertilisers and chemical plant protection products. This may be a barrier to the improvement of farming efficiency, and therefore may adversely affect the ability to pursue environmental goals in the long term in the entire agriculture sector. Runowski (2009) emphasises that the income-to-expenditure ratio is quite narrow in organic farming. Therefore, an important aspect of the functioning of organic farms is to supplement the incomes with external funds (subsidies) and with higher prices of organic products compared to conventional products. However, there are certain restrictions to both of these sources of supplementary income for organic producers. This is because, according to a survey conducted by Nestorowicz *et al*. (2009) with Polish residents of large cities (with a population above 50,000), both frequent and occasional purchasers as well as non-purchasers of organic food find these products to be too expensive. However, at the same time, frequent consumers admitted that organic food was good value for money. In turn, according to studies by Smoluk-Sikorska and Łuczka (2014), demand factors, primarily including low consumer incomes, are the key barriers to the development of the organic food market. The average level of expenditure on organic products in Poland in 2015 was more than twelve times lower than the overall EU average, reaching EUR 4.4 per capita. The Polish organic products market was worth EUR 167 million, and the share of organic food in the total foodstuffs market was around 0.5 per cent. However, in recent years, the Polish market for these products has experienced a dynamic growth at an estimated annual rate of around 15 per cent (Łozińska-Wróbel, 2017; Willer *et al*., 2017). Nevertheless, despite some symptoms of improvement on the demand side of the organic food market, organic farming may be expected to remain for a long time a system focused on a relatively narrow market niche and on a specific consumer group.

As regards external sources of financing for organic farms, the above data show the vital importance of operating activity subsidies for the functioning of farms. It may also be noted that the significantly higher level of subsidies

Table 3: Efficiency of organic and conventional farms by economic size class (EUR), 2014.

Feature name	Very small 2,000 < 8,000	Small 8,000 < 25,000	Medium-small 25,000 < 50,000	Medium-large 50,000 < 100,000
Conventional farms				
Land efficiency (PLN/ha)	742	1,338	1,909	2,315
Labour efficiency (PLN/AWU)	5,157	14,233	32,322	57,847
Capital efficiency (PLN/PLN 100 total assets)	-0.6	1.3	3.2	4.8
Family farm income per FWU (SE430) (PLN/FWU)	6,307	15,738	34,651	66,780
Total subsidies, excluding on investment (SE605) (PLN)	10,798	20,070	34,250	56,691
Share of total subsidies in family farm income (%)	137	82	55	45
Organic farms				
Land efficiency (PLN/ha)	1,128	506	965	1,044
Labour efficiency (PLN/AWU)	8,534	7,187	19,426	37,928
Capital efficiency (PLN/100PLN total assets)	0.3	0.6	1.8	4.2
Family farm income per FWU (SE430) (PLN/FWU)	14,920	19,468	41,274	92,702
Total subsidies, excluding on investment (SE605) (PLN)	17,342	35,911	68,830	135,192
Share of total subsidies in family farm income (%)	98	123	94	76

Note: EUR 1 = PLN 4.3
Data source: Polish FADN

accessed by organic farms was related to their lower capacity to generate incomes (compared to conventional holdings). As a result, it may be concluded that the economic situation of organic farms depends more strongly on subsidies which compensate, to a large extent, for the lower efficiency.

These issues matter in the context of the future of organic farms. The unknown development of the CAP after 2020 and the foreseen reduction of funds allocated to support the agricultural sector are factors that mean that organic producers face a difficult, precarious situation. Dilemmas surround many issues, such as various strategies contributing to improving the economic situation as the subsidies are restricted, including the ability to reduce production costs as a consequence of extending the production scale or seeking new sales channels to boost demand. As a part of policy planning, it should be taken into consideration that organic farms may encounter in the future a development barrier stemming from lower efficiency, difficult access to subsidies and, finally, lower levels of income. In addition to indisputable environmental benefits for the entire population, organic farming may also become an opportunity for farmers operating under unfavourable conditions which make conventional farming difficult and economically unviable. Therefore, in the long run, it will provide positive economic effects.

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