

ANALYSIS OF ECONOMIC PERFORMANCE AND OPPORTUNITIES FOR THE DEVELOPMENT OF ORGANIC FARMING: CASE STUDY OF THE CZECH REPUBLIC

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This article deals with organic farming in the Czech Republic and discusses ecological agriculture of the country in both perspectives, consumer and a production point of view. This article presents the results of a primary data collected after questionnaire survey. This survey revealed the popularity of organic products among consumers. Furthermore, the popularity of individual products, a higher willingness to pay, and other aspects like the application of organic products on the market was determined. For evaluation of the selected dependency, the chi-square (χ^2) test of goodness of fit was used. To assess the economic point of view (production view), data from the FADN (Farm Accountancy Data Network) database were used. The conventional and organic systems are compared in the article. A comparison of the costs and benefits of selected products in both farming systems is also provided.

Keywords: Economic performance, organic products, organic farming, ecological agriculture.

INTRODUCTION

Over the last two decades, the importance of environmental protection has been emphasized, and customer demand for products without negative effects on the environment has been significant (Unruh and Ettenson, 2010a,b; Unruh, 2008). It is assumed that customers have a higher demand for products with environmentally friendly characteristics, and are also willing to pay a higher price. At the same time, as other authors pointed out the fact that an environmentally friendly product does not lead to an automatic increase in customer demand for these products. Customers also consider other factors (price, performance, quality, availability), and these factors can prevail (Ginsberg and Blom, 2004).

A friendly approach to the environment can also provide businesses with other benefits on the input side. These include less material consumption and less waste production, etc. (Porter, Linde, 1995). Overall, this approach should have a positive impact on competitiveness and economic performance (Waddock and Graves, 2007; Hillman and Keim, 2001). For example, Sharma and Vredenburg (1998) observed that proactive responsiveness of the firms can build specific organizational capabilities. And these capabilities have impact on the competitiveness of the firms.

Organic farming is a system which takes a careful approach to the landscape, soil, animals and plants. The benefits of organic farming include a friendly approach to the use of production factors. The management of organic farming systems also fulfills many non-productive functions, because organic farming respects many principles that are closer to

natural farming systems. More organic matter is leached into the soil and a more varied crop rotation system is used, which reduces wind and water erosion. Greater biodiversity is generally achieved (Sarapatka and Zidek, 2005; Sarapatka and Urban., 2006). According to some opinions, organic farming provides opportunities to adapt to climate changes (Muller *et al.*, 2013).

When we compare the production of organic with conventional agriculture, lower yields are expected. Primarily, the reason for this is the decommissioning of substances which are prohibited in organic agriculture. Yields of cereals, however, could stabilize at the level of 60 – 80% of the conventional system, depending on various factors (soil quality, habitat, etc.). On the other hand, the costs for prohibited substances (pesticides, herbicides, etc.) are lower in organic farming. Simultaneously, costs for livestock manure and other expenditures on manual labour are higher (Moudry *et al.*, 2008). Thus, organic farms suffer from higher prices and production risks than conventional farms (Berentsen *et al.*, 2012). In light of this, organic farming receives higher subsidies to compensate them for farming under strict regulations in the EU. In organic system, it is not allowed to use for example chemical protection agents, chemical fertilizers etc. (COM. Reg. No 889/2008). The subsidies are given by the agricultural and environmental policy in individual countries. For example, in the Czech Republic, the Rural Development Program is valid for the period 2016 – 2020. The subsidies for organic farms are for example 80 EUR/ha/year for permanent grassland, 178 EUR/ha/year for arable land etc. These subsidies are not given

for conventional farms. Also, Brenes-Munoz and Lakner (2016) state that the growth of organic farming in Germany is influenced by subsidies.

The sale of organic products has its own specifics. Sales can be divided into two types – direct and mediated. Both forms of marketing have advantages and disadvantages for farmers. The main advantage of direct sales is the fact that the farmer does not share profits with other players. The disadvantage is that the farmer has to handle other processing activities and invest more resources into processing technology. The main forms of direct sales are self-picking, direct service, sales in stalls and yard sales (Moudry and Prugar, 2001). Farmers have to use various forms of sales; it is also important to use different forms of promotion and marketing (Newton, 2004). The importance of the study arises from the brief introduction given above. In the Czech Republic, the growing popularity of organic products goes hand in hand with increasing area of organic farming, bigger offer of the organic products in the grocery retailers and farmers' markets as well as with increasing number of people for which is the consumption of organic products a lifestyle. The environmental care and the attractiveness of the environmental friendly products are one of the current trends. Simultaneously, a certification of products is not the only factor for commercial success of these products. The objectives of the study are to observe the selected success factors (prices, supply of organic food, distribution channels, reason for buying organic food) in the Czech Republic and to compare the chosen indicators of main organic and conventional crop products in the Czech Republic in order to evaluate the "organic" boom in more complex way.

MATERIALS AND METHODS

A questionnaire was used for the original research in this article. Customers in the Czech Republic were target group for the questionnaire research. The sample size contained 730 completed questionnaires. CAWI method were used for questioning. To ensure its explanatory power, the questionnaire was pre-tested. Basic information on the demographic characteristics of respondents was collected; this included age, level of education and size of residence (according to population). For evaluating the questionnaire, the methods of descriptive statistics were used. The χ^2 -test of goodness of fit was used for verification of the dependence. A standard level of significance $\alpha = 0.05$ was required. Statistical software Statgraphics Centurion XVI was used for the analysis.

The Farm Accountancy Data Network (FADN) was used for analysis of the economic performance of conventional and organic farming. FADN is an instrument for evaluating the income of agricultural holdings and the impacts of the Common Agricultural Policy. The aim of the network is to gather accountancy data from farms for the determination of incomes and the business analysis of agricultural holdings.

The published standard results of FADN CZ provide a detailed view of the economic results by type of farming and economic size. The standard results also provide information about the position of agricultural holdings, with an orientation toward market agricultural production.

The FADN CZ annually collects representative sample of agricultural companies in the Czech Republic. FADN CZ uses stratified sampling method. For the purposes of surveys in the EU statistics, the special classification system of agricultural enterprises has been introduced. It enables each farm to be classified according to its economic size and its type of farming. The regression estimation with a known value of regression coefficient β is a statistical method how to determine the minimum number of respondents in the sample. The sample includes around 1 600 agricultural holdings every year. When testing the representativeness, following economic indicators are tested for variability – total production, crop production, livestock production and gross value added. These tests are carried out for various aggregation size groups of enterprises and types of farming.

RESULTS AND DISCUSSION

The basic socio-demographic characteristics are given in Table 1.

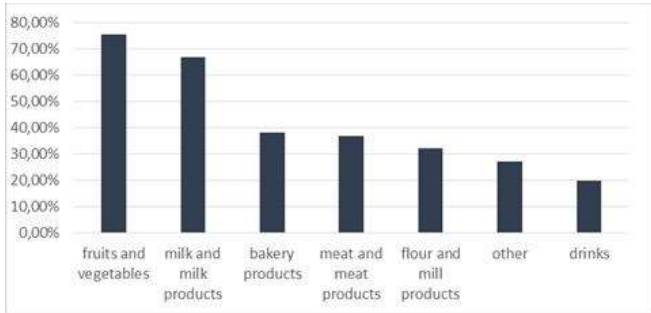
Table 1. Basic socio-demographic characteristics of the obtained sample.

Characteristic	Frequency	Percentage (%)	
Age (year)	0 – 22	112	15.34
	23 – 40	426	58.36
	41 – 60	161	22.05
	61 and over	31	4.25
	TOTAL	730	100.00
Education	Primary education and secondary school without leaving-certificate	58	7.95
	Secondary school with leaving-certificate	323	44.25
	University education	349	47.81
	TOTAL	730	100.00
Population of residence	0 – 3,000	170	23.29
	3,001 – 10,000	97	13.29
	10,001 – 50,000	118	16.16
	over 50,000	345	47.26
	TOTAL	730	100

Resource: Authors own calculation

The consumer issue in organic farming: Organic food is bought by 55% of respondents. The answers below give the percentage of respondents who buy organic food. The most common place in which to purchase organic food is a specialized shop for organic products. 60% of respondents buy from these shops. The second and third most frequent

places of purchase are the marketplace (53%) and the farmer or producer (52%). 48% of respondents buy in retail chains. Other distribution channels (Internet stores, etc.) are underused. Figure 1 shows the proportions of the main categories of organic food bought by respondents.

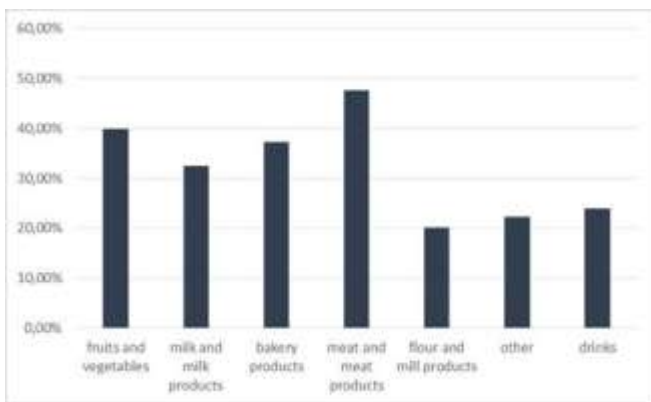


Resource: Author's own calculations

Figure 1. The buying proportions of the main categories of organic food.

Consumers mostly buy organic fruits and vegetables (76%) as well as milk and dairy products (67%). They purchase significantly fewer bakery products (38%), meat and meat products (37%) and flour and other mill products (e.g. bread and bakery products) (32%). Only 20% of respondents buy organic drinks.

Figure 2 provides information about organic foods which respondents would like to have in greater supply. The respondents would like to have the largest expansion in the supply of the organic food categories meat and meat products (48%), fruits and vegetables (40%), bakery products (37%) and milk and dairy products (33%). The supply seems to be sufficient in drinks and other products, and in flour and grain mill products. Only 20% of respondents would like greater supply for these groups of products.



Resource: Author's own calculations

Figure 2. The wishes for greater supply of the main categories of organic food.

The main reason for buying organic food is that it tastes better. This factor is important for 63% of respondents. For 61% of consumers, another significant factor is the fact that organic food production is environmentally friendly. Respondents (58%) also assume that organic food is healthier than conventional products.

The main disadvantage of organic foods is their high price. This factor is cited by 57% of respondents. The distribution network seems to be sufficient, according to the research. This factor is mentioned as a disadvantage by only 26% of respondents. The product assortment also seems to be sufficient. Only 17% of respondents marked this factor as a disadvantage.

The other areas of the survey correspond to the factor of high price. Firstly, the average monthly expenditure on organic food was asked. Secondly, the willingness to pay higher prices for organic food compared to conventional food was discovered. Table 2 provides information about the average monthly expenditure for organic food.

Table 2. The average monthly expenditure for organic food.

Amount	Percentage (%)
0 – 200 CZK	13.55
201 – 500 CZK	34.24
501 – 1000 CZK	27.34
1001 – 3000 CZK	20.94
3001 – CZK	3.94
TOTAL	100.00

Note: 1 CZK \approx 0.05 USD

Resource: Author's own calculations

A significant proportion of respondents (almost 50%) spend up to 500 Czech crowns per month. Respondents (27%) spend between 500 and 1,000 Czech crowns monthly, and 21% of respondents spend between 1,000 and 3,000 Czech crowns. Only less than 4% spend more than 3,000 Czech crowns for organic food monthly.

The survey also shows that 60% of respondents are willing to pay up to 20% higher prices for organic food compared to conventional food. Another approximately 36% of respondents are willing to pay from 20–50% more. Less than 5% of respondents are willing to pay more than 50% higher prices. Table 3 provides information about “chi-square (χ^2)” and “P-value” through a dependence evaluation between the chosen factors.

A dependence between age and organic food purchases can be seen. It was demonstrated (P-value = 0.0003) that younger people rather than older people buy organic foods. No dependence between age and amount of expenditure was demonstrated. Furthermore, it was demonstrated (P-value = 0.0000) that more consumers buy organic foods in major cities.

Table 3. Chi-Square (χ^2) and P values.

		Chi-Square (χ^2)	P-value
FACTOR – Age	Organic food purchases	18.673	0.0003
	Amount of expenditures	1.121	0.7719
FACTOR – Population of residence	Organic food purchases	34.133	0.0000
	Amount of expenditures	14.801	0.0965
FACTOR – Education	Organic food purchases	19.135	0.0001
	Amount of expenditures	1.815	0.4035

Resource: Author's own calculations

At the same time, it was not demonstrated with sufficient probability (P-value 0.0965) that expenditures on organic foods increase with a growing population of the residence.

A dependence between education and the purchase of organic food was demonstrated (P-value = 0.0001). Organic foods are bought more by customers with a higher education. Again, no dependence between level of education and amount of expenditures was demonstrated (P-value = 0.4035).

A higher supply of fruits and vegetables is missed by consumers, especially in residences with a population of 0 – 50,000 inhabitants. A higher supply of meat and meat products is demanded, particularly by respondents in residences with a higher population (over 10,000 inhabitants). The supply of flour and mill products is insufficient, especially in small residences (0 – 3,000 inhabitants). The supply of milk and milk products in residences with a population of 3,001 to 10,000 inhabitants is characterized as relatively small.

As the results of the survey show, organic farming has the potential to produce higher profits for organic farmers. This result is consistent with the findings of Panneerselvam *et al.* (2013). These authors have calculated that average total farm gross margin, or net return, is 13 % higher for organic farms than for conventional farms. Offermann and Nieberg (2000) also state that the premium price for organic products varies between 50 and 200%. The size of the premium price depends on country, products and other factors. Michelsen *et al.* (1999) state a similar conclusion. According to these authors, premium prices vary from 0 to 100%. The higher prices apply especially for products such as vegetables, potatoes and fruits. The lower premium prices apply for products such as milk and beef.

As mentioned above, 328 respondents said they do not buy organic food. The reasons, why consumers do not buy organic food were determined. The main reason is lack of confidence in bio-certification. This reason is given by 65% of respondents from this group. The high price is a barrier for 55% of respondents. Other reasons are not so important. Respondents (24%) stated that conventional foods are good enough. 8% did not have the options to purchase organic food.

Economic issues of organic farming: Foreign research studies and main findings raise several questions on the level of costs and yields in Czech organic and conventional farms.

A comprehensive survey on the costs and yields of organic farming in the Czech Republic was carried out during the period 2001 – 2005 by Polackova *et al.* (2006). The sample represents between 12 and 15% of agricultural land under organic farming in various regions of the Czech Republic. The study focuses on the costs and yields of selected agricultural commodities. Organic farms often keep meadows and pastures for feeding livestock. In crop production, organic farms plant a wide spectrum of crops, from general field crops like cereals and potatoes to specialized crops like triticale, buckwheat, millet and medicinal herbs. Organic livestock production concentrates on cattle breeding, especially on suckler cows. Suckler cow is a cow used to breed and suckle calves for beef. In words, suckler cows are primarily fattened for meat, not for milk. They are often bred in the more extensive system of grazing farming on pastures.

Costs and yields of winter wheat, oats, barley and potatoes are described in Table 4. Costs and yields on suckler cows (all categories) and dairy cows are included in Table 5 below.

Table 4. Costs and yields of main organic and conventional crop products during 2001 - 2005 in the Czech Republic.

Crop	Indicator	Organic farming (O)	Conventional farming (C)	Index (O/C)
Winter wheat	Total costs (CZK/ha)	10.405	15.165	0.69
	Yields (t/ha)	2.810	5.100	0.55
	Total unit costs (CZK/t)	3.437	2.641	1.30
	Average output price (CZK/t)	3.521	3.049	1.15
Barley	Total costs (CZK/ha)	10.598	12.871	0.82
	Yields (t/ha)	3.030	4.330	0.70
	Total unit costs (CZK/t)	3.030	2.550	1.19
	Average output price (CZK/t)	3.231	3.435	0.94
Oats	Total costs (CZK/ha)	9.679	9.579	1.01
	Yields (t/ha)	2.290	3.190	0.72
	Total unit costs (CZK/t)	3.595	2.590	1.39
	Average output price (CZK/t)	3.065	3.247	0.94
Potatoes	Total costs (CZK/ha)	59.605	70.199	0.85
	Yields (t/ha)	13.490	25.250	0.53
	Total unit costs (CZK/t)	4.506	2.814	1.60
	Average output price (CZK/t)	4.944	3.031	1.63

Note: 1 CZK \cong 0.05 USD, t =tonne/metric ton (1000kg), ha=hectare
Resource: Authors, based on a survey by Polackova *et al.* (2006)

Total costs per hectare in organic farming are generally lower than in conventional farming. Significantly lower costs for fertilizers and phytosanitary inputs lead to differences in total costs per hectare. Organic farms use almost no purchased fertilizers. Instead, they use their own fertilizers. Moreover, organic farms do not usually use phytosanitary inputs. They attempt to maintain healthy vegetation through various technological procedures.

On the other hand, organic farming suffers from lower crop yields, by almost 50–70% on average. Since the gap between yields per hectare is wider than differences in total costs per hectare, the total unit costs per tonne are higher in organic farming. Higher unit costs should be offset by higher unit output price per tonne. Table 4 shows that unit output price per tonne is higher than total costs per tonne in the case of winter wheat, barley and potatoes. Therefore, the profitability of those crops was positive without current subsidies in the period 2001 – 2005. Nevertheless, it is not possible to generalize that organic farms always receive higher output prices than conventional farms.

The results about lower input costs in organic farming correspond to conclusions made by Patil *et al.* (2014). They also revealed that nutrient balances in organic agriculture are negative for all crop rotations, indicating an imbalanced supply of nutrients. It is therefore impossible to sustain current yields over the long term with current nutrient applications. Delbridge *et al.* (2013) also emphasize the need for crop rotation in order to make organic farming more sustainable.

Table 5. Costs and yields of the main organic and conventional livestock products during 2001 - 2005 in the Czech Republic.

Cattle	Indicator	Organic farming (O)	Conventional farming (C)	Index (O/C)
Dairy cows	Total costs (CZK/year/cow)	38.85	49.34	0.79
	Milk yields (l/year)	4.253	5.735	0.74
	Total unit costs (CZK/l)	8.200	7.810	1.05
	Average output price (CZK/l)	8.150	7.990	1.02
Suckler cows	Total costs (CZK/year/cow)	17.23	17.19	1.00

Note: 1 CZK ≅ 0.05 USD, 1 = liter

Resource: Authors, based on a survey by Polackova *et al.* (2006)

Total costs per year in organic dairy farming are lower than in conventional farming. This is mainly due to the lower costs of fine purchased feed. Organic farms usually mix relatively expensive purchased bio-feed with their own forage, which is less nutritious. The different structure of feed costs has a significant impact on milk yields, which were 20 – 30% lower in organic farming during the period 2001 – 2005. Organic

dairy farms produce more extensively through grazing farming. This has an impact on lower staff costs and depreciation of tangible assets and animals. Extensive farms do not need to have reconstructed cow houses, and often use pens. The average age of dairy cows in organic farming is higher than in conventional farming, which reduces depreciation of animals. Thus, total unit costs per litre of milk are higher in organic farms. However, milk yields and total unit costs per litre in organic and conventional farming are gradually getting closer together. In the period 2001 – 2005, the average output price did not cover total unit costs. The profitability of organic dairy farming was therefore negative, as opposed to conventional farming. Given the opportunity, organic dairy farms could receive a higher price through their own processing and marketing cooperatives.

The costs of organic suckler cows did not differ from conventional farms in 2001 – 2005. The breeding of suckler cows is a highly extensive type of farming, on both organic and conventional farms. Costs for feed make up about one-third of total costs. Since the organic and conventional technologies for breeding suckler cows do not differ markedly, the costs are at the same level. Unfortunately, the survey did not correctly capture the revenue aspects of breeding suckler cows. This also raises the question of the recent whole farm profitability of breeding suckler cows under Common Agricultural Policy schemes.

The findings concerning organic and conventional cattle breeding are in accordance with other authors (Delate *et al.*, 2003; Pimentel *et al.*, 2005; Urfi *et al.*, 2013; Gillespie and Nehring, 2013). At the same time, studies point out that the extra price for organic products is often insufficient to achieve greater profits every year.

Moreover, the profitability of organic farming depends heavily on the structure of current subsidies in the EU. Organic farms generally have a higher ratio of subsidies to sales than conventional businesses (Aulova and Frydlova, 2012). In order to create a comprehensive whole-farm picture of the extensive breeding of suckler cows, including the impact of current subsidies, it is possible to use farm-level data from the FADN. Every year, FADN collects accountancy and natural data from a sample of the agricultural holdings in the European Union. Table 6 contains the number of organic and conventional farms surveyed in the Czech Republic in the period 2007 – 2011. The analysis compares entirely organic farms with entirely conventional farms. Farms which are transitioning to organic are excluded.

Table 6. The number of farms in the Czech Republic specialized in breeding suckler cows

Type of farming	2007	2008	2009	2010	2011
Conventional	39	59	88	88	53
Organic	48	50	60	81	120

Resource: Authors, based on the FADN survey.

Table 7 shows key items of the FADN Standard Results concerning important structural and economic features of conventional and organic farming in the period 2007 – 2011.

Table 7. Structural and economic indicators for organic and conventional farms in the Czech Republic specialized in breeding suckler cows.

Indicator	Unit	Organic farming (OC)	Conventional farming (C)	Index (O/C)
Total labour input	AWU/100 ha	1.540	2.690	0.57
Unpaid labour input	FWU/100 ha	0.470	0.410	1.16
Utilized agricultural area	ha/farm	306.200	312.200	0.98
Share of forage crops (f. c.)	%	96.700	75.000	1.29
Livestock density	LU/ha of f.c.	0.380	0.710	0.54
Total production	CZK/LU	22.058	39.301	0.56
Crop production	CZK/LU	9.383	14.565	0.64
Livestock production	CZK/LU	9.670	21.596	0.45
Other production	CZK/LU	3.006	3.140	0.96
Total costs	CZK/LU	44.331	52.204	0.85
Intermediate consumption	CZK/LU	29.030	34.145	0.85
Specific (material) costs	CZK/LU	12.070	19.582	0.62
Overhead costs	CZK/LU	16.960	14.563	1.16
Wages	CZK/LU	7.402	11.008	0.67
Current subsidies	CZK/ha	13.911	10.197	1.36
Environmental payments	CZK/ha	4.924	1.740	2.83
Subsidies on less favoured areas	CZK/ha	3.312	2.152	1.54
Net value added	CZK/LU	23.627	18.184	1.30
Net value added per AWU	CZK/AWU	609.269	378.339	1.61
Farm income	CZK/LU	14.368	5.876	2.45

Note: LU = livestock unit, 1 CZK \cong 0.05 USD; (average of 2007 – 2011), ha = hectare

Resource: Authors, based on the FADN survey

Organic farms in the Czech Republic which specialize in breeding suckler cows use a lower labour input than conventional farms. This results from organic production being distinctly more extensive, with 0.38 LU per hectare of feed crops. Alternatively, organic farms use slightly more of their own unpaid labour. Conventional farms therefore produce more intensively, using more paid labour input than organic farms, which has an impact on the differences in wages paid. Forage crops cover almost the entire utilized

agricultural area in organic farms. This means that organic farms use permanent grasslands to breed suckler cows, whereas conventional farms also produce field crops and usually mix fodder with purchased feed mixes. Such technology increases the material costs of conventional farms. On the other hand, the livestock production of organic farms reaches only 45% of the production of conventional farms.

A comparison of total costs and total production indicates that both organic and conventional breeding of suckler cows would be in the red without current subsidies. The deeper losses of organic farms are offset by higher environmental payments, which can be perceived as payment for the production of public goods. Moreover, subsidies for less favoured areas offset the lower farm income in disadvantaged areas.

Statements about the pros and cons of extensive agricultural production in organic farming support the research results of Elhendy and Alkahtani (2013). They apply Data Envelopment Analysis (DEA) models to evaluate the resource management of conventional and organic date farms by Saudi farmers. Their study showed that organic farms have significantly lower technical efficiency compared to conventional farms. Most of the respondents operate very far away from the efficiency frontier. Lower technical efficiency is generally linked to an extensive type of farming, which is more typical for organic farms (Mala, 2011).

Conclusion: The results of consumer research showed that consumers are interested in organic products in the Czech Republic. Consumers in the Czech Republic buy primarily fruits and vegetables, milk and milk products, and mill products. Customers are willing to pay a higher price for organic products. The vast majority of consumers are willing to pay no more than 50% more for organic products compared to conventional products. Organic products are purchased mainly by younger consumers, in larger cities and with a higher education. Based on the research, one can draw the conclusion that organic products have potential in the market of the Czech Republic. Producers must focus on an area with an insufficient range and provide the products at a reasonable price.

A comparison of costs and revenues between organic and conventional farming confirms the theoretical assumptions about higher average unit costs in the production of organic crops and organic livestock products. Organic farms have lower costs per hectare or livestock unit and, at the same time, they achieve lower yields. Moreover, the lower technical efficiency of broadly extensive organic farms is the main cause of higher average unit costs. The analysis also revealed that the prices of organic products are not always higher than the price of conventional products e.g. in case of barley and oats production.

Organic and conventional production in the EU is significantly affected by support under the Common

Agricultural Policy of the EU (CAP) scheme. Organic farms currently receive higher subsidies, primarily environmental payments for public goods and payments for farming in less favoured areas. Current subsidies shift the income of organic farms from loss to profit. The difference in current subsidies is particularly obvious in the extensive breeding of suckler cows, which is the most frequent type of organic farming in the Czech Republic.

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