

The opportunities of generating income at the parity level by farms specializing in milk production in Poland

Możliwości realizacji dochodu na poziomie parytetowym przez gospodarstwa specjalizujące się w produkcji mleka w Polsce

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Abstract

The article presents the economic situation of farms specialising in milk production in Poland in the 2004-2009 period. These data base on the survey of agricultural holdings in the European Union carried out under the Farm Accountancy Data Network system. The research aimed at determining the size of production scale, measured by the number of cows on the farm providing enough income to pay for the work of farmers and their family members at the parity level, i.e. level which is achieved by those employed in the national economy. The income situation of farms was analysed taking into account the support in the form of direct payments and without this support. Research shows that parity income is achieved in farms that have stronger links with the market. On average for the 2004-2009 period, farmers keeping at least 28 cows with a yield at the level of the 5,300 kg of milk and without payments were able to achieve income which surpassed parity income. The situation of those farms is stable to the point that small fluctuations in the milk prices, or the prices for means of production, do not cause a negative financial result. Farms with smaller herds of cows are much more susceptible to changes in the market economy and it is often the case that the EU payments save their economic situation. On the basis of the results obtained, it can be concluded that given the appropriate scale, intensity and organisation of production agricultural holdings can provide stable welfare to families.

Keywords: dairy cows, farm income, parity income, payments, production cost, scale of production

Streszczenie

W artykule przedstawiono sytuację ekonomiczną gospodarstw specjalizujących się w produkcji mleka w Polsce w latach 2004-2009. Źródłem danych były badania gospodarstw rolnych w Unii Europejskiej prowadzone w systemie Farm Accountancy Data Network. Celem badań było określenie wielkości skali produkcji, mierzonej liczbą krów w gospodarstwie, która zapewni dochód pozwalający na opłatę pracy rolnika i członków jego rodziny na poziomie parytetowym, tzn. na poziomie, jaki uzyskują zatrudnieni w gospodarce narodowej. Sytuację dochodową gospodarstw analizowano uwzględniając wsparcie w postaci dopłat bezpośrednich oraz bez tego wsparcia. Badania dowodzą, że dochody parytetowe osiągane są w gospodarstwach,

które mają mocniejsze powiązania z rynkiem. Średnio w latach 2004-2009 rolnicy utrzymujący przynajmniej 28 krów o wydajności na poziomie 5300 kg mleka, bez wsparcia dopłat uzyskali dochód, który przewyższał dochód parytetowy. Sytuacja tych gospodarstw jest na tyle stabilna, że niewielkie wahania cen mleka, czy cen środków produkcji nie powodują ujemnego wyniku finansowego. Gospodarstwa o mniejszych stadach krów są znacznie bardziej podatne na zmiany koniunktury rynkowej i często dopłaty unijne ratują ich sytuację ekonomiczną. Na podstawie otrzymanych wyników można stwierdzić, że przy odpowiedniej skali, intensywności i organizacji produkcji gospodarstwo rolne może dawać stabilne warunki utrzymania rodzinie.

Słowa kluczowe: dochód parytetowy, dochód z gospodarstwa, dopłaty, koszty produkcji, krowy mleczne, skala produkcji

Detailed abstract

Ocenę sytuacji dochodowej gospodarstw specjalizujących się w produkcji mleka w Polsce przeprowadzono na podstawie danych gromadzonych w systemie Farm Accountancy Data Network (FADN EU) w latach 2004-2009. Celem było zbadanie możliwości realizacji przez te gospodarstwa dochodu, który zapewni opłatę pracy rolnika i członków jego rodziny na poziomie parytetowym, tzn. na takim poziomie, jaki uzyskują zatrudnieni w gospodarce narodowej. Wyniki gospodarstw przedstawiono w latach badań oraz w grupach wydzielonych według wielkości ekonomicznej wyrażonej w ESU. Do badań wybrano gospodarstwa zakwalifikowane do czterech klas wielkości ekonomicznej, tj. 4-8, 8-16, 16-40 i 40-100 ESU. Zbadano wpływ dopłat bezpośrednich na efekty gospodarowania oraz stopień zadłużenia gospodarstw.

Wyniki badań wskazują na silne zróżnicowanie sytuacji dochodowej gospodarstw. Różnice determinowane są sytuacją rynkową oraz skalą produkcji mleka w gospodarstwach. W latach 2004-2008 gospodarstwa wspierane przez dopłaty i utrzymujące 14-15 krów o wydajności mlecznej na poziomie 4900 kg, zrealizowały dochód, który umożliwił opłatę pracy rolnika i członków jego rodziny na poziomie parytetowym. Natomiast w 2009 roku przy spadku ceny mleka a rosnących cenach środków produkcji ten rozmiar skali produkcji mleka okazał się niewystarczający, pomimo wsparcia dopłat. Średnio w badanym sześcioleciu (2004-2009) dochód na 1 członka rodziny o 13,1% przewyższał dochód parytetowy. Natomiast bez wsparcia dopłat, dochód uzyskany z produkcji stanowił tylko 70,7% poziomu parytetowego.

W Polsce w ujęciu ilościowym przeważają gospodarstwa bardzo małe i małe ekonomicznie (mierzone wielkością ESU), mniej jest gospodarstw średnich, a relatywnie niewiele dużych i bardzo dużych. Szczególnie trudna jest sytuacja gospodarstw zakwalifikowanych do dwóch pierwszych grup. Jedną z przyczyn trudności natury ekonomicznej jest mała skala produkcji i słaba pozycja tych jednostek na rynku. Badania dowodzą, że dochody parytetowe osiąmane są w gospodarstwach, które mają mocniejsze powiązania z rynkiem. Średnio w latach 2004-2009 gospodarstwa małe, tzn. utrzymujące 8 krów o wydajności około 4100 kg mleka i wspierane przez dopłaty nie opłaciły pracy rolnika i członków jego rodziny na poziomie, jaki uzyskują zatrudnieni w gospodarce narodowej. Natomiast gospodarstwa utrzymujące co najmniej 28 krów mlecznych o wydajności 5300 kg miały stabilną sytuację dochodową i bez wsparcia dopłat zapewniły użytkownikom dochód porównywalny z osiąganym przez pracujących w działach pozarolniczych. Ocenia się, że sytuacja tych jednostek jest na tyle stabilna że niewielkie wahania

cen mleka, czy cen środków produkcji nie spowodują ujemnego wyniku finansowego.

Wraz ze wzrostem siły ekonomicznej gospodarstw rolnicy w coraz większym stopniu korzystali z kredytów. Wyraźna jest współzależność między wielkością ekonomiczną gospodarstw a udziałem kredytów długoterminowych w zobowiązaniach ogółem. Kredyty długoterminowe na ogół przeznaczane są na inwestycje, co może oznaczać dalszy rozwój gospodarstw.

Czynnikiem decydującym o wynikach ekonomicznych gospodarstw i opłacalności produkcji mleka jest skala produkcji mierzona liczbą krów i ilością sprzedanego mleka. Poprawa sytuacji dochodowej tych gospodarstw będzie zależeć również od możliwości obniżenia jednostkowych kosztów produkcji. Ze względu na wzrostową tendencję cen środków produkcji, rolnicy chcący w dłuższej perspektywie czerpać dochody z produkcji rolniczej powinni skupić się na realizacji strategii niskich kosztów. Ocenia się, że skierowanie celowych środków (z funduszy unijnych lub długoterminowych niskooprocentowanych kredytów) na budowę i modernizację budynków oraz dalszy postęp techniczny i biologiczny w produkcji mleka będzie stymulowało wzrost skali produkcji, a jednocześnie przewagi konkurencyjnej. W chwili obecnej mleko produkowane jest niemal we wszystkich regionach świata i taka tendencja prawdopodobnie jeszcze długo utrzyma się w przyszłości. Dlatego konieczne jest podjęcie działań zmierzających do zapewnienia silnej pozycji wśród producentów działających na rynku globalnym.

Introduction

In Poland, agricultural commodity production is dominated by the segment of livestock production. In 2004-2011 its share was within the range of 53.4-62.6%. In this segment the dominant branch is milk production, which accounted for 29.2-33.5% of commodity production (Główny Urząd ..., 2005b, 2008a, 2010c, 2012b). The rearing of dairy cattle and milk production have an important role in generating income, both for farms keeping dairy cows and for agriculture as a whole. In the years 2004-2011 population of dairy cows decreased by 10.4% (from 2,729.5 to 2,445.9 thousand cows) (Główny Urząd ..., 2005a, 2012a). Population reduction was caused by reduction of the number of herds of dairy cows as a result of quotas for milk production after Poland's accession to the EU and the high quality requirements for cow's milk. These requirements were not possible to be met for many farmers due to a lack of funds for modernising farms and consequently it resulted in their resignation from dairy farming. According to the National Agricultural Census (Główny Urząd ..., 2011) data, in 2010 as compared to 2002, the number of farms with dairy cows decreased by more than two-times (from 874 to 424 thousand). At the same time, there was a concentration of cow breeding. Density per 1 farm increased from 3.3 cows in 2002 to almost 6 cows in 2010.

The decline in the population of cows was linked to elimination of cows with a lower yield and improvement of production technologies. As a result, the reduction of herds and a decrease in the number of cows were offset by systematic growth in cows' milk yield. In 2004-2011 cows' milk yield in Poland increased by 13.1% and, despite the lower number of cows, it resulted in milk production increasing by 5% (Główny Urząd ..., 2005b, 2012b).

Increased yield is a direct way to reinforce the importance of this production trend on the country scale. The figures published by the Polish Federation of Cattle Breeders

and Dairy Farmers (Polska Federacja ..., 2011) show that 90.6% of cows in the country are animals of the Polish Holstein Friesian breed. We can thus consider that the majority are cows of a considerable genetic potential. Therefore, the continuously low levels of average milk yields are caused by too low standards of nutrition and breeding. Research shows that diet is one of the most important factors affecting the results of milk production. It causes around 70% of variability in cows' milk yield, while the impact of breeding progress is usually about 30% (Wielgosz-Groth, 2008).

Progress that has been made in recent years in Polish dairy industry is a favourable phenomenon, but the gap between the largest producers in the EU still remains large, e.g. in terms of the scale of production or yield of dairy cows. From the research of the European Commission (EC, 2011) follows that in 2008 the average number of cows per 1 farm in Poland amounted to 16 LU, and the average milk yield was 5,345 kg/cow in the farms covered by the FADN survey and specialising in the production of milk. In comparison, the highest milk yield of cows at the level of the 8,483 kg/cow was reported in Finland, followed by Sweden (8,411 kg/cow) and Denmark (8,160 kg/cow). Nevertheless, Poland's share of milk production in the EU market is significant. In 2008, it amounted to 7% which ranks it on the fifth position (jointly with Italy). The largest producer of milk in the European Union is Germany (20% of total production), followed by: France (17%), the United Kingdom (9%) and the Netherlands (8%). It should be added that in Poland, milk producers do not directly compete with milk producers from other countries, but they have a considerable impact on the competitive position of Polish milk processing plants, which to a large extent depends on the cost of the raw material (Ziętara, 2012).

In Poland, despite the support of the payments, there are still many farms which economic situation has not improved substantially and farmers' incomes are lower than the average salary in the national economy. Studies show that income at the parity level is achieved in farms which have a strong connection with the market (Poczta, Siemiński, 2009).

The article presents the economic situation of farms specialising in milk production in Poland in the 2004-2009 period. The primary objective was to examine the feasibility of income for those farms, which would provide remuneration for farmers' work and members of their family at the parity level, i.e. at the level achieved by those employed in the national economy. In order to do this, a minimum scale of production was determined and this was measured by the number of cows on the farm. Also examined was the impact of direct payments for the outcomes of farm management and the effects of internal transformations occurring in farms. It was assumed that to achieve mentioned objectives it will be helpful to verify the following hypotheses:

- production of milk on a sufficiently large scale provides an income comparable to achieve by the employees in the national economy,
- farm with a large area and conducting milk production on a large scale are more dependent on payments than farms with a small area and small-scale milk production.

Materials and methods

The assessment of the economic situation of dairy farms in Poland was conducted on a sample of farms where milk production was the dominant. In accordance with the principles of the Community Typology of Agricultural Holdings, these holdings are referred to as specialising in milk production. For the purposes of analysis the most current data available were used, i.e. for the 2004-2009 period, which were collected

and processed in a system for the collection and use of accountancy data from the EU farms, known as the Farm Accountancy Data Network (FADN) (Farm Accountancy..., 2013). FADN information is aggregated into a Standard Results Database, include the average values for groups of farms selected by type of farming and economic size. Results for subsequent years is not presented due to the modification of parameters Community Typology of Agricultural Holdings.

Results of farms were presented for each year in a tabular format, based on the average in the research period (2004-2009) and in groups of farms categorised according to economic size in ESU (European Size Unit – the equivalent of 1 ESU is EUR 1,200). Farms qualified to four classes of economic size were selected for research, i.e. 4-8, 8-16, 16-40 and 40-100 ESU. The results for each group of farms were presented as average values in the years of the research. Vertical and horizontal analysis was used by comparing parameters characteristic for farms in the given years, and in separate groups, i.e. economic size classes.

Farm income was used as a basic measure of outcomes assessment, but the research also covered production value and costs. In order to conduct research according to the goal set, parity income was calculated based on public statistics, corresponding to the average net salary in the national economy. This calculation was done for each year of the research. The European Central Bank's conversion rates were used to convert parity income from PLN to EUR.

For the purposes of a more detailed assessment of the condition of farms, their assets and debts were also examined. Ratio analysis was carried out to analyse the results of the ones that have been settled. With the aim of the research in mind on the one hand, and the nature of available data on the other, the following indicators were selected:

$$\text{Fixed assets to current assets [ratio]} = \frac{\text{fixed assets}}{\text{current assets}}$$

$$\text{The farms debt rate [\%]} = \frac{\text{total liabilities}}{\text{total assets}} \times 100$$

$$\text{The debt structure ratio [\%]} = \frac{\text{long-term liabilities}}{\text{total liabilities}} \times 100$$

The fixed assets to current assets ratio indicates the degree to which the farm goods are immobilised. The higher the ratio, the longer the immobilisation period. If the ratio is higher than the value of 1.0, then the value of fixed assets is greater than the value of the current assets. The farms then have less flexibility in carrying out restructuring changes and adapting to market transformations (Nowak, 2008).

The indicator describing the degree of indebtedness of farms shows which part of the value of the assets are liabilities. It therefore specifies the security level for repayment of all debt in farms with their assets and thus points at the financial risks associated with carrying out production activities. The higher the result of this indicator, the greater the financial risk. The degree of indebtedness of individual agricultural holdings should not exceed 50% (Goraj and Kulawik, 1995; Nowak, 2008). However, the indicator of debt structure is expressed as a percentage of the value of long-term liabilities in total liabilities. A higher result of this indicator means more financial stability of agricultural holdings (Nowak, 2008).

Also, cost absorption of agricultural production was analysed. Its value was determined by referring the total cost to the value of production. Furthermore, the

burden of direct costs on production was expressed as a percentage ratio of direct costs to the production value. Also was assessed the scale of dependence of farms on support in the form of operating payments. The impact of direct payments on the outcomes of farm management was determined.

The work also includes data on the cost of total labour input on the farm (Annual Work Unit – AWU, expressed in work conversion units, i.e. persons working full-time = 2,200 hrs/year). After bringing this into a single reference datum, information on the production's labour-intensity was obtained. Also presented was the data on the cost incurred on one's own work (Family Work Unit – FWU, expressed in work conversion units, i.e. persons from the family working full-time = 2,200 hrs./year).

Results

After 2004 in Poland, farms specialising in milk production saw considerable biological and technical progress. It is manifested in greater milk yield of cows, which compared to the 2004 increased by 12.2% in farms surveyed in 2009, and in the growing concentration that helps to reduce the cost per unit of production. During the six years (2004-2009) analysed, the number of dairy cows per farm increased on average by 1.5 LU (livestock unit). The share of milk and its products also increased in the total value of production on farms. There were also changes in the way of animal nutrition. This is evidenced by a greater share of fodder crops in agricultural areas (by 7.2 percentage points). The effect of these changes was the increase in the economic size of farms, which grew by more than 3 units expressed in ESU – table 1.

Table 1. Organisation of production on farms specialising in milk production in Poland in the 2004-2009

Parameter	Years of research						On average in 2004-2009
	2004	2005	2006	2007	2008	2009	
Economic size of farms [ESU]	9.7	9.5	12.5	12.4	12.6	12.8	11.6
Area of agricultural land (AL) [ha]	15.58	17.55	20.71	20.01	20.47	20.78	19.18
Share of fodder crops in AL [%]	54.9	62.6	61.9	62.3	60.9	62.1	61.0
Total labour input per 100 ha of AL [AWU]	11.55	10.14	8.88	9.00	8.84	8.76	9.53
Own labour input [FWU]	1.75	1.73	1.77	1.75	1.76	1.77	1.76
Dairy cows [LU]	13.6	13.4	14.8	14.6	14.8	15.1	14.39
Milk yield of cows [kg/cow]	4,508	4,689	5,001	4,981	4,986	5,060	4,871
Share of the value of milk and milk products in total production [%]	68.6	70.9	69.0	66.5	68.4	70.0	68.7

Source: Own compilation based on FADN EU (Farm Accountancy ... 2013).

Judging from the perspective of the results achieved in the last few years by farms specialising in milk production in Poland, it must be concluded that the mechanism functioning in the market to limit production (milk quotas) did introduce some

restrictions and did not hamper their development. In commercial farms, farmers who wanted to increase milk production obtained new production limits (in the administrative sphere or through flows of quotas between farms). At the same time, the infrastructure of farms was modernised. This was necessary to adapt to the quality requirements in force in the EU, while also promoting the use of more labour-saving production techniques. This is evidenced by the lower labour intensity of production (from 11.55 AWU in 2004 to 8.76 AWU in 2009) – table 1.

The economic effect of activities is income from the farm. Its value determines the level of consumer needs satisfaction of farmer's family and development potential of the farm. In 2004-2009, the amount of income on farms specialising in milk production in Poland has fluctuated widely. Its highest level was reported in 2007 and compared to 2006 this income increased by 23.6% (table 2). Several factors were decisive for it, but mainly the exceptionally favourable market conditions for agriculture.

In 2007 in Poland, the prices of agricultural products sold by individual farms increased by 14.5%, i.e. more than two-fold more than those for goods and services bought (6.3%). As a result, the price ratio indicator was at 107.7% (figure 1). According to public statistics data (Główny Urząd ..., 2005c, 2008b, 2010b), the price of milk was highest in 2007 during the period analysed and amounted to PLN 1.07 per litre (in 2004 the price for 1 litre of milk in PLN was – 0.87, in 2005 – 0.93; in 2006 – 0.93; in 2008 – 1.02; in 2009 – 0.90).

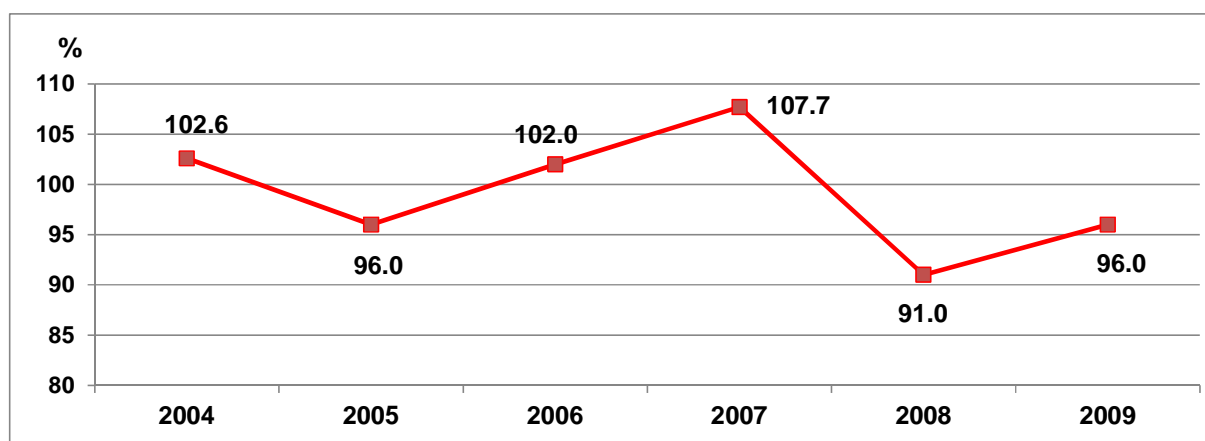


Figure 1. The price ratio of agricultural products to goods and services bought by individual farms in Poland in 2004-2009

Source: Author's own compilation based on the data of the Central Statistical Office (Główny Urząd ..., 2010a).

In 2004-2007, milk producers in Poland reported a progressive increase in income from farms, while the next two years brought a deterioration of conditions for farm management, resulting in a drop in income. This was due to exceptionally unfavourable market conditions. In 2008, the average increase in the price of products sold by individual farms amounted to 1.2%, while the increase in prices of goods and services bought was even at the level of 11.2%. As a result, the price ratio indicator decreased to the level of 91.0%. In 2009, the economic conditions of production were still unfavourable, the price ratio indicator was at a level of 96.0% – figure 1.

As a result of unfavourable market conditions the income situation of dairy farms deteriorated and that despite stronger support through payments. In 2008, compared to 2007 – farm income decreased by 16.2% and in 2009 by another 34.4%. In 2009, the drop in income was particularly strong. Its value exceeded the level of income in 2004 by only about 7.5% (which was lowest in the years analysed); while support through payments was about 144% higher. The scale of farm income support through the CAP instruments is well reflected by the level of funding the cost of generating one economic size unit (ESU) by farms through payments on current operations. In 2004, the payments were used to fund 19% of the cost of 1 ESU, while in 2009 this stood at a level which was by about 9 percentage points higher.

The payments recorded at the level of agricultural holdings have had and will in the future have a direct impact on the level of income of farms. However, the strength of their impact on income depends on the value of economic surplus generated from production and the amounts of payments received.

Table 2. Economic and production performance of farms specialising in milk production in Poland in the 2004-2009

Parameter		Years of research						On average in 2004-2009
		2004	2005	2006	2007	2008	2009	
Total production value	[EUR/farm]	17,575	20,191	25,787	30,587	31,061	22,457	24,610
Total costs	[EUR/farm]	11,952	13,104	17,565	19,673	23,653	19,547	17,582
The income of a farm with payments	[EUR/farm]	7,554	8,843	11,951	14,775	12,383	8,123	10,605
	[EUR/FWU]	4,317	5,112	6,752	8,443	7,036	4,589	6,041
Share of payments on current operations in the income of a farm	[%]	29.3	25.2	38.3	29.1	41.8	66.6	37.6
Ratio of income with payment per 1 FWU to the net salary in the national economy	[%]	106.6	107.9	132.6	148.1	104.6	79.8	113.1
The income of a farm without payments	[EUR/farm]	5,341	6,614	7,374	10,473	7,207	2,714	6,621
Ratio of income without payment per 1 FWU to the net salary in the national economy	[%]	75.4	80.7	81.8	105.0	60.9	26.7	70.7
Cost absorption of production	[%]	68.0	64.9	68.1	64.3	76.2	87.0	71.4
Burden of direct costs on production	[%]	34.0	30.9	33.6	33.2	39.0	43.5	35.8

Source: See table 1.

Income from farms determines the achievement of competitive advantages by farms, but at the same time, its amount per 1 person working full-time (FWU) shows the potential amount of payment for the work done by a farmer and members of their family. By comparing this income with parity income, we can determine whether the farmer manages to achieve remuneration for their own work at the level of those

employed in the national economy. Research has shown that in 2004-2008, milk producers achieved income at parity level, while in 2009 it accounted for only 79.8% of its level (in the years of research, parity income in EUR per 1 person working full-time amounted to: in 2004 – 4,048, in 2005 – 4,738, in 2006 – 5,093, in 2007 – 5,701, in 2008 – 6,728, in 2009 – 5,749). On average for the 2004-2009 period the income per 1 member of the family employed full-time surpassed the average salary in the national economy by 13.1%. It can therefore be considered that farms rearing 13-15 cows with a yield of approximately 4,900 kg and supported by payments met the requirements for parity farms – table 2.

In the light of obtained results it was deemed relevant to examine the income situation of those farms without payments. It was determined whether the volume of finished production would be enough to achieve income at the parity level. The results contained in table 2 show that this was possible only in 2007. In the remaining years, income was between 26.7-81.8% of the average salary in the national economy, while the average in the years of research (2004-2009) was at 70.7%. These results suggest that the volume and value of finished production were too small (small scale of production) or the production was carried out in a manner that was too expensive.

The costs in the production process are an important element in decision-making and their level depends mainly on the farmer. Farmer's choice is based on the use of owned factors of production to produce the products with the greatest benefit. Analysis type input/product allows to determine a reasonable level of intensity of production and is an important element of economic calculation. This dependence is a cause-and-effect relationship, where the used factors of production are the cause, and volume of production are the results. Farmer's efforts to improve production in a short period of time can do so only through greater investment into variable factors of production (the supply can be increased quickly and without additional investment). While the fixed factors of production (land, buildings) can not be rapidly increased. However, in the longer term all factors are variable.

By referring the level of cost to the value of production generated based on it, we can get information that helps to manage the manufacturing process. Research results show that in 2004-2007 the cost absorption of production on farms fluctuated only slightly and was within the range of 64.3-68.1%. However, in the next two years, i.e. in 2008 and 2009, this indicator was at the level of 76.2 and 87.0% respectively. This indicates much higher costs incurred for generating the production. In 2008 compared to 2007, the cost absorption of production increased by 11.9 percentage points, and in 2009 by another 10.8 percentage points. A relatively large increase in the proportion of costs in the value of production, which occurred in 2008-2009, shows a general increase in the prices of factors of production used for agricultural. This situation points to the deteriorating conditions for agricultural activity.

An analysis of the burden of total costs on production was supplemented by using an indicator of the burden of direct costs on agricultural production. The amount of this burden was calculated as a percentage of the ratio of direct costs to production value. In 2008-2009 the burden of direct costs on production also showed strong growth (5.8 and 4.5 percentage points, respectively) reflecting the deteriorating profitability of agricultural production. This means that the strong growth of production cost intensity entailed a proportional increase in the burden on direct costs with this production. This is evidenced by similar variation in both of those cost items – table 2.

In recent years we have seen growth dynamics which is stronger than that of the cost of production. Studies carried out with the use of statistical analysis of classic trend models show that this trend will continue over the next few years. This will result in lower production efficiency. In this situation, farmers wishing to increase income should increase the scale of production and aim to lower the cost of production (Skarżyńska, 2012).

Agricultural production economics are determined by many factors of a macro- and microeconomic nature. The latter include, first and foremost, the selling price of products and the cost of means of production; these factors are exogenous, i.e. farmers can have little impact on their level. The second group of factors is represented by the organisational structure of farms, i.e. scale of production and related specialisation, animal breeding system, farm size and the extent of its link with the market. In order to improve the profitability of milk production, farmers can change the organisational structure of holdings (by adjusting their production volume accordingly), thus achieving better indicators of farm management and raising the efficiency of manufacturing factors. These factors are of an endogenous nature.

For assessment of the economic impact of changes in the organisational structure of dairy farms, the research covered farms differing in economic size and the number of cows related to this as well as the surface of utilised agricultural areas. The research covered four ranges in the scale of economic size of farms, i.e. 4-8, 8-16, 16-40 and 40-100 ESU. The results are presented as a mean in the years of research.

Table 3. Organisation of production depending on the economic size of farms specialising in milk production in Poland on average in the 2004-2009

Parameter	Scale of the economic size of farms in ESU			
	small 4-8	medium small 8-16	medium large 16-40	large* 40-100
Economic size of farms [ESU]	6.0	11.6	23.0	53.1
Area of agricultural land (AL) [ha]	11.72	19.31	34.92	73.71
Share of fodder crops in AL [%]	58.0	59.2	61.7	67.2
Total labour input per 100 ha of AL [AWU]	14.08	9.67	6.00	3.98
Own labour input [FWU]	1.64	1.83	1.98	2.23
Dairy cows [LU]	8.1	14.6	27.5	59.3
Milk yield of cows [kg/1 cow]	4,128	4,554	5,329	6,378
Share of the value of milk and milk products in total production [%]	61.5	66.8	71.6	77.4

* In 2004-2005 there were no farms in this size class. The presented results reflect average data in the 2006-2009.

Source: See table 1.

The figures contained in table 3 indicate that with the increased economic size there was a clear increase in the specialisation of farms. This is evidenced by the growing number of cows (8.1-59.3 LU), their milk yield (4,128-6,378 kg/1 cow) and the ever-increasing share of total production of milk in the total value of production on farms (61.5-77.4%). Also greater was the efficiency of the use of resources owned. This is

evidenced by a decline in the labour-intensity of production (from 14.08 to 3.98 AWU per 100 ha of AL). The farms analysed varied in economic size and related surface of agricultural areas, which will be within the range of 11.72-73.71 ha. In addition, there was an ever-increasing proportion of fodder crops in agricultural areas (58.0-67.2%). The correlation between economic size and the share of fodder crops in agricultural land was statistically significant – was 0.787. This indicates a strong positive dependence between these variables (Tatarzycki, 2007). This is a positive effect of organisational changes in farms, which is important because of the way of the nutrition of dairy cows (i.e. composition of the feed ration), and the cost of their keeping as a result.

Research shows that the way of nutrition is one of the most important factors affecting milk yield of cows, especially with a high milk yield. At the same time, the composition of cow feed ration, i.e. the proportion of quality roughage in the ration has a big impact on the cost of their keeping and economic efficiency of milk production (Skarżyńska and Jabłoński, 2012).

According to many authors (Delaby, et al., 2009; Fal and Emanuelson, 2011) the composition of the feed ration is a factor affecting changes in the chemical composition of milk, i.e. its quality. Nahar, et al. (2007) found that feeding with green forage and concentrate feeds affects the increase in dry mass content in milk, including fat and proteins. However, research by Chabuz, et al. (2012) has shown that the highest content of these components is found in cow's milk, whose feed ration contains a large proportion of corn silage.

The proportion of dry mass from roughage in the cows' feed ration during lactation should be about 60%. In the ration for cows with very high milk yield, this is equivalent to 40 kg/day. Sometimes, in order to meet the needed intake of proteins and energy, it is necessary to reduce the proportion of roughage feed in favour of concentrate feeds. As a safe minimum, it can be assumed that 50% of the dry mass of the ration should be roughages. This means that the concentration of proteins and energy in 1 kg of dry mass of roughage should be similar or even the same as that in concentrate feeds (Włodarczyk and Budvytis, 2011).

Table 4 shows the results of farms differing in economic size with which the number of farmed cows was closely correlated. The differentiation of results in favour of large farms (40-100 ESU) is clear, both on the level of revenue and the income achieved. Compared to small farms (4-8 ESU), what draws our attention is the proportion of payments in farm income which is lower by about 22.9 percentage points. Statistical analysis showed that the share of payments on current operations is significantly correlated with economic size of farms. The value of the correlation coefficient (-0.369) indicates a moderate negative correlation. However the amount of payments per 1 ha of agricultural area in groups of holdings was similar and was within the range of EUR 194-221. In this situation, the lower impact of payments on the performance of large farms testifies to the higher economic surplus achieved from production, and greater efficiency as a result. This is also evidenced by cost absorption which is lower by 7.4 percentage points.

Production in small farms (4 to 8 ESU), i.e. with rather small cow herds, is often run using old production technologies. In the units analysed, which in 2004-2009 bred on average 8 cows (with a yield at the level of 4,100 kg of milk), this situation resulted in a low income from farms (5,009 EUR/farm). Payments accounted for 51.5% of this income. Such a high share of payments has not led to improved economic performance

because income was insufficient to ensure a parity level counted per one full-time family member (representing 57.5%). As a consequence, development investments, which in future could improve the economic situation of those farms, are impossible. The data in table 4 indicate the diversity of the importance of subsidies received by farmers to generate income of particular groups of farms. They also point to the dependence of the level of payments from the area of the farm. Payments in large farms (40-100 ESU) attributable to one full-time employee of a family member (1 FWU) was 4.6-fold higher than in small farms (4-8 ESU). This means that payments are not similarly beneficial for all farms.

Table 4. Production performance and economic performance depending on the economic size of farms specialising in milk production in Poland on average in 2004-2009

Parameter		Scale of the economic size of farms in ESU			
		small 4-8	medium small 8-16	medium large 16-40	large* 40-100
Total production value	[EUR/farm]	11,665	23,027	50,983	137,484
Total costs	[EUR/farm]	8,993	16,428	34,567	95,765
The income of a farm with payments	[EUR/farm]	5,009	10,070	22,374	57,197
	[EUR/FWU]	3,070	5,503	11,314	25,642
Payments on current operations	[EUR/FWU]	1,581	2,177	3,429	7,316
Share of payments on current operations in the income of a farm	[%]	51.5	38.4	30.3	28.6
Ratio of income with payment per 1 FWU to the net salary in the national economy	[%]	57.5	103.0	211.8	440.8
The income of a farm without payments	[EUR/farm]	2,431	6,203	15,590	40,850
Ratio of income without payment per 1 FWU to the net salary in the national economy	[%]	27.9	63.4	159.4	315.0
Cost absorption of production	[%]	77.1	71.3	67.8	69.7
Burden of direct costs on production	[%]	34.9	35.3	36.1	38.5

* In 2004-2005 there were no farms in this size class. The presented results reflect average data in the 2006-2009.

Source: See table 1.

Studies show that the differentiation of farms' area is one of the reasons why small and medium-sized farms, ie the agricultural land area of 15 hectares, are not affected at all, or affected only slightly by positive impact of direct payments on income situation. While farms for which direct payments is likely to represent a significant contribution to improving the income of a farm with an area of 15 ha (Chmielewska, 2007). In Poland such farms is only about 196 thousand (about 9%).

The scale of production measured by the number of dairy cows on farms, which – with the support of payments – guaranteed parity income, is on average 15 cows with a milk yield of about 4,600 kg. These were farms with a size of 8-16 ESU. However, obtaining income at the parity level was only possible thanks to direct payments. Without this contribution, income from the production generated accounted only for

63.4% of parity income, i.e. average salary in the national economy (per 1 person working full-time). At this stage of the analysis the role of payments became more noticeable. Its share in the income of those holdings amounted to 38.4% – table 4.

The analysis showed that only the farms with the economic size of 16-40 ESU, i.e. breeding an average of 28 dairy cows with a yield of 5,300 kg had an income situation which, without the support of payments, was stable enough to provide income comparable to that achieved by those working in the non-agricultural sectors. Income per 1 person working full-time (FWU) exceeded parity income by 59.4%, which for the 2004-2009 period was EUR 5,343 on average. The economies of scale are very clear. Yet, a still more favourable situation was seen for farms with the economic size of 40-100 ESU breeding an average of 59 cows with a milk yield at the level of 6,400 kg. Income from production exceeded parity income by 215.0%, which in the case of this group of farms averaged EUR 5,818 (this being due to four years of research).

An important factor for Polish farms which fosters the concentration of milk production, and one that has a positive impact on the performance as a result, is the cooperation of milk processing plants with suppliers and making the purchase prices of milk dependent on its quality and the scale of supplies. The research conducted in 2009 showed that farms which kept 24 or more cows achieved a much higher price for milk than the average price of milk in the country (Skarżyńska, 2011).

Research results indicate that economically large farms (40-100 ESU), compared to medium large ones (16-40 ESU), were characterised by a very pronounced increase in the cost amounting even to 2.8 times. With regard to the other farm groups, the cost advantage was even greater. This may be due to the fact that, after joining the EU, many farms aimed to increase production by increasing their herds. An increase in the herd is mostly associated with investments, i.e. the need to modernise the existing buildings or building new facilities such as milking parlours.

Statistical analysis indicate a strong positive correlation between economic size of farms and the amount of the costs for 1 ha of agricultural land. The correlation coefficient was 0.845. However, despite the higher cost of running a farm, the cost absorption of production expressed as a percentage ratio of total costs to the value of total production, for example big farms compared to small farms, was lower by 7.4 percentage points. However, the burden of direct costs in production was about 3.6 percentage points higher. This indicates a higher specialisation and production intensity. It also shows that the proportion of direct costs in total costs is higher, which was highest in large farms at 55.3%, while in medium large units it stood at the level of 53.2%, in medium small ones at 49.5% and in small ones at 45.2%.

The results of the calculations contained in table 5 and 6 describe the efficiency in the use of assets. They allow us to state that farms specialising in milk production in Poland had little aptitude to carry out any restructuring and to adapt to market trends. This is evidenced by the fixed assets to current assets ratio which is higher than 1.0.

The assets structure on those farms was not favourable as evidenced by the high proportion of fixed assets with little mobility (an average of 88.7%). The high proportion of fixed assets in the property of farms generates high fixed costs and represents a factor limiting the ability to achieve a relatively high income. Assets structure dominated by the current assets is more beneficial for farms because these assets create opportunities for adaptation to the needs of the market, and as a result contribute to the growth of income.

Table 5. Selected indicators characterising the use of assets on farms specialising in milk production in Poland in the 2004-2009

Parameter		Years of research						On average in 2004-2009
		2004	2005	2006	2007	2008	2009	
Fixed assets to current assets	[ratio]	7.5	7.9	7.3	6.8	6.8	10.6	7.8
Share of fixed assets in total assets	[%]	88.2	88.8	87.9	87.2	87.2	91.4	88.7
The farms debt rate	[%]	8.7	8.4	11.1	10.5	10.3	6.2	9.0
The debt structure ratio	[%]	74.9	76.7	75.9	77.3	77.9	75.9	76.6

Source: See table 1.

Performance in groups of farms differing in economic size is differentiated by indicators describing the willingness of farmers to use loans – table 6.

Table 6. Selected indicators characterising the use of assets depending on the economic size of farms specialising in milk production in Poland in the 2004-2009

Parameter		Scale of the economic size of farms in ESU			
		small 4-8	medium small 8-16	medium large 16-40	large* 40-100
Fixed assets to current assets	[ratio]	8.5	7.8	7.8	8.0
Share of fixed assets in total assets	[%]	89.5	88.7	88.6	88.9
The farms debt rate	[%]	2.7	6.7	12.9	18.7
The debt structure ratio	[%]	63.5	73.5	78.8	79.6

* In 2004-2005 there were no farms in this size class. The presented results reflect average data in the 2006-2009.

Source: See table 1.

To assess the degree of indebtedness of farms an indicator calculated as a ratio of liabilities to total assets was used. With the increase in the economic size of farms, farmers increasingly resorted to loans. In large farms this indicator amounted to 18.7%, despite the fact that this level should be judged as low. The differences are also evident when assessing the structure of liabilities. There is a clear interdependence between the economic size of farms and the share of long-term loans in total liabilities (the correlation coefficient was 0.712). In small farms (4-8 ESU) this indicator amounted to 63.5% and in large ones (40-100 ESU) – to 79.6%. Long-term loans are generally intended for investment, which could mean further development for farms.

Farmers from other EU countries, for example, in Romania or Bulgaria are also show little inclination to use loans. The three primary barriers making it more difficult to agricultural producers to benefit from loans are high and variable interest rates, high

demands from banks regarding guarantees and too short repayment periods (Hertz, 2009; Pfeiffer, et al., 2009; Safavian, et al., 1998).

Conclusions

Polish farms specialising in the production of milk have made use of the opportunities created by the EU membership and strengthened their position in the European market. This is evidenced by the fact that in the first years after accession (2004-2005) the FADN sample had no economic size units of 40-100 ESU. Such farms can be found in the research since 2006. This means that the holdings have become economically stronger. Changes in organisational structure contributed to this, including increased scale of production as measured by the number of cows and the amount of milk sold.

The research conducted shows that the income of medium large (16-40 ESU) and large (40-100 ESU), thriving farms is independent from small fluctuations in milk prices or from the prices of means of production. Also, a possible lack of direct payments will not result in a negative financial result. On average in 2004-2009 income without payments per 1 person working full-time (FWU) surpassed the average salary in the national economy. This means that farmers keeping at least 28 cows with a milk yield of 5,300 kg achieved income at parity level. The economic potential of those farms indicates their further development.

The medium-small farms (8-16 ESU) which kept 15 cows with a milk yield of about 4,600 kg achieved income at the parity level only with the support of payments. Without their share, income from production represented only 63.4% of parity income. The situation of small farms (4-8 ESU) which are very susceptible to changes in the market is very different and very adverse. Only in their case the received EU payments were able to save the economic situation. The production in these farms was on a small scale (8 cows with a milk yield of 4,100 kg), and as a consequence, the income obtained (despite the support of payments) represented only 57.5% of the average salary in the national economy.

With the increase in the economic size of farms, farmers increasingly used loans. There is a clear interdependence between the economic size of farms and the share of long-term loans in total liabilities. Long-term loans are generally intended for investment, which could mean further development for farms. The decisive factor for the economic results of farms and the profitability of milk production is the scale of production measured by the number of cows kept and milk sold. Improvement of the income situation of those farms will depend on the possibility of reducing the cost per production unit. Due to the upward trend in the prices of the means of production, farmers wishing to derive income from agricultural production in the long term should focus on implementing low cost strategies. The resulting level of income should provide not only a continuity of production in the short term, but also ensure opportunities for the development and improvement of the quality of production in the future. It is estimated that using targeted funds (from the EU funds or long-term low-interest loans) for the construction and modernisation of buildings and further technical and biological progress in milk production will stimulate growth in the scale of production and at the same time the competitive advantage among milk producers.

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