

SPATIAL DIFFERENTIATION OF MILK MARKET DEVELOPMENT IN POLAND

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Abstract. The aim of the paper is to recognize spatial differentiation of milk market development in Poland. The authors present spatial differentiation of milk production in Poland. The highest production was observed in Mazowieckie province (543.42 thou. cows) in 2010 and Podlaskie province (457.68 thou. cows in 2010). The number of cows and total milk production in Poland decreased and the milk yield per unit increased. The milk price changed in the years 2010-2015. The integration processes in the milk market vary. The biggest number of milk producers is in Wielkopolskie province, which is the third largest milk producer in Poland, whereas Podlaskie province, which is the second largest milk producer, has only one group.

Key words: milk market, price volatility, milk, efficiency.

JEL code: Q11, Q14

Introduction

Milk production is an important agricultural activity in the world. The world milk production is increasing. It increased from 490.4 million tonnes to 614.3 million tonnes from 2000-2011. The European Union has a significant part of world production (24.3%) (Mickiewicz B., Mickiewicz A., 2014).

The production of milk is diversified in the world. New Zealand, North America, Europe and Australia are regions with an overproduction of milk. The surplus of production over consumption increased in the USA to 8% in the years 2005-2010. Other regions such as Asia and Africa recorded an increase of milk consumption because of population increase, which led to an increase of imports (Seremak-Bulge J., Bodyl M., 2013).

Milk production is a fundamental part of agricultural production in Poland, with production of about EUR 2.5 bln, which accounts for 20% of Polish agricultural production in 2005. The milk production quality is represented by producers on one hand and by milk cooperatives on the other hand. The cooperatives process the production to satisfy EU rules (Wasilewski M., Chmielewska M., 2006).

The dairy sector is a key part of the Polish food economy. The competition on the market is created not only by farmers but also by dairy enterprises, which create the market (Zietara W. et al., 2013). It is responsible for the 2.5% of the production value of all industry and 15% of the value of the food industry. Poland plays a significant role in milk production compared to other countries of the European Union and the world, and is the fourth producer of milk in the

European Union (EU) (Roman M., 2014). Poland has a climate well suited for milk production, good infrastructure, the potential for grassland development, and access to deep water (Johnson M., 2014). The location of many Polish dairy farms, the economic size of dairy farms and milk efficiency have an impact on the profitability of dairy farms (Borawski P., Dunn J.W., 2015).

However, the milk market in Poland faces challenging conditions recently due to the Russian embargo and the instability in the Middle East and North Africa, which together reduced world market prices and negatively impacted Polish milk prices (Milk market, 2015). The liquidation of the quota system may result in many changes on the milk market. Most dairy farms in Poland are small and the elimination of the quota system may result in the liquidation of small farms, increasing the share of milk supply and more development of larger farms (Koloszyc E., Switlyk M., 2015).

The milk market was the most regulated market in Poland. The Common Agricultural Policy introduced special tools to regulate milk production. The quota system that was introduced in 2003 ended after 2014 (Borawski P., Dunn J.W., 2015). In the new perspective 2015-2020, the EU prepared many changes, including negotiation between producers and processors. The convention concerning delivery of milk will be signed by farmers and processors on the one hand but the production limits were abandoned on the other hand (Wilczynski A., Switlyk M., 2012). The latest introduced tools support a cheese-production programme and the possibility to create a multi-branch organization (Guba W., Dabrowski J., 2012).

One of the determinants of breeding cows and milk production is the capacity to feed and the amount of certain types of agricultural land (forage area). The size of the meadows and pastureland in Poland decreases over time, due to changing agricultural practices (Zuba-Ciszewska M., 2014; Pawlewicz A., 2014). However, Poland still has an agrarian structure with mainly small farms that limits farm efficiency. This has been a weakness. This agrarian structure is a remnant of the history of the country and region and depends on political and socioeconomic relations (Klepacki B, Zak A., 2013).

The production of milk in Poland in 2015 is expected to be 12687 mln l (13059 mln kg) or 0.6% higher than the previous year. This is the effect of increasing productivity of dairy cows (2.9%) and technological progress, regardless of the worsening relationship between milk prices and the prices of grains and fodders (Milk market, 2015).

The consumption of milk per capita is increasing in the world. In the years 2005-2013, the consumption of milk increased by 8.1% from 101.4 kg/person to 109.6 kg/person. This is the result of an increased awareness of society on the importance of healthy food (*The World Dairy Situation*, 2015). Milk is a product rich in calcium, potassium and albumin, which are all necessary in the

human diet. The success of milk in the market depends on its ability to fulfill specific needs. The product ensures buyers certain benefits (Zuchowski I. et al., 2014).

The aim of this paper is to present the spatial differentiation of milk production in Poland after integration into the European Union. To develop the problem of milk differentiation, the authors attempt to answer the following questions:

- 1) What is the density of cows in Poland?
- 2) How does milk production vary regionally?
- 3) Is the production of milk integrated?

The authors used tabular, graphic and descriptive methods to present the changes of milk production. The authors presented data about milk market development in Poland in the years 2005-2015 mostly in analysis of the milk price and dairy herds.

Research results and discussion

In 2010, Poland produced 12270 thousand tonnes of milk. The production of milk in Poland increased in the years 2005-2015 by 12.6%. In the same period, the number of dairy cows decreased in Poland from 2750 thousand in 2005 to 2180 thousand in 2015 (Table 1).

Table 1

Dairy cows, milk production, sale and milk yields in Poland (2010-2015)

Years	Specification				
	Dairy cows (in December in thousand units)	Milk production (in thousand tonnes)	Total sale (in million litres)	Total purchase (in million litres)	Milk yields per cow (in litres/cow)
2005	2750	11600	9050	8378	4190
2010	2529	12270	9521	9761	4488
2011	2446	12405	9735	9043	4618
2012	2346	12659	12125	9584	4845
2013	2299	12710	12219	9643	4978
2014	2248	12976	10707	10326	5164
2015	2180	13059	10837	10522	5270
Changes 2005=100	79.3	112.6	119.7	125.6	125.8

Source: author's construction based on data from the Ministry of Agriculture and Rural Development, 2015

There are many factors behind the decrease in the number of dairy cows. The most important is the decline in the profitability of production. Particular

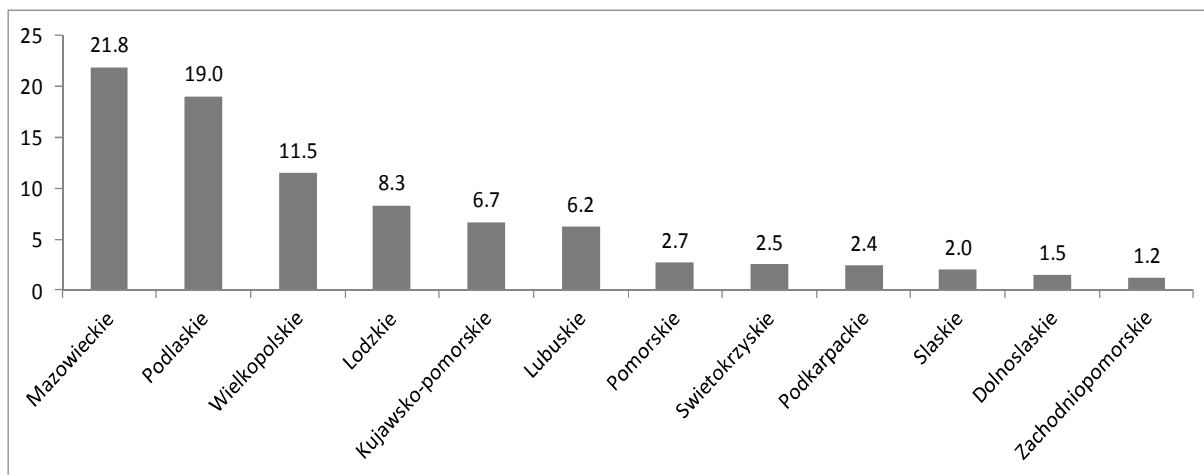
attention should be paid to lower milk prices, especially given the introduction of the Russian embargo on food products from the EU. The other reason for decreasing

cow numbers was the cost for exceeding milk quotas and the poor base of roughage for some farms, with the rotation of dairy cows. The reduction of dairy cows was caused by the elimination of poorer cows and replacing them by more productive cows.

One of the most important issues is that higher yielding cows are more profitable. A higher milk yield decreases unit production costs while freeing labour on the farm (Manko S., 2007). But an important question is how to measure profitability, or economic surplus, which the farmer can use (Skarzynska A., 2012). Milk per cow increased 25.8% in the period 2005-2015. This was the effect of better fodders and better cows.

As Sosnowski J., et al. (2014) point out, the milk yield on the Polish farms having more cows was up to twice as high as farms having 10 or fewer dairy cows. In the years 2004-2012, the rise of yield per cow in Poland was 18.7%, with the highest increase in Mazowieckie province (40.9%), Wielkopolskie (35.4%) and Kujawsko-pomorskie province (22.9%).

The dairy cow population is diversified in Poland. The share of dairy cows in 2014 was the highest in three provinces: Mazowieckie, Podlaskie and Wielkopolskie (Figure 1). The share of the national population of dairy cows exceeds 52% in these three provinces.



Source: author's construction based on Milk Market (State and Perspectives 2015)

Fig. 1. The share of dairy cows population by provinces (%)

The integration with the EU has caused changes in the level and structure of livestock production. There has been a differentiation of dairy cows in particular provinces in Poland (Figure 2). This trend proves that the indicator of dairy cows changes is below 100 in most provinces in Poland. Only Swietokrzyskie (100.5), Wielkopolskie (103.4), Podlaskie (103.9) and Kujawsko-pomorskie (104.5) provinces increased the number of dairy cows in 2015 in comparison to 2014. The indicator of dairy herd size increased in the years 2005-2015 in the following provinces: Wielkopolskie (10.6%), Slaskie (8.9%), Podkarpackie (6.8%), Malopolskie (4.9%), Swietokrzyskie (1.7%), Kujawsko-pomorskie (0.9%), Podlaskie (0.3%). Other provinces recorded the decline of dairy cows herd in the years 2005-2015 mainly, in: Lubuskie (-27%), Lubelskie (-11.9%), Warminsko-Mazurskie (-7.1%), Lodzkie (-7.0%), Mazowieckie (-4.0%), Dolnoslaskie (-3.3%) and Pomorskie (-1.8%).

The number of dairy cows has declined between June 2014 and June 2015 in 12 of 16 provinces by 1.0-23.9%. The number of cows decreased almost 25% in Lubuskie province. The provinces of Lodzkie, Dolnoslaskie, Mazowieckie and Opolskie reduced the number of cows by 4.8-7.7%. The dairy herd decreased by 2.4-3.1% in Warminsko-Mazurskie, Pomorskie, Podkarpackie and Lubelskie, and in Slaskie and Malopolska by approximately 1%.

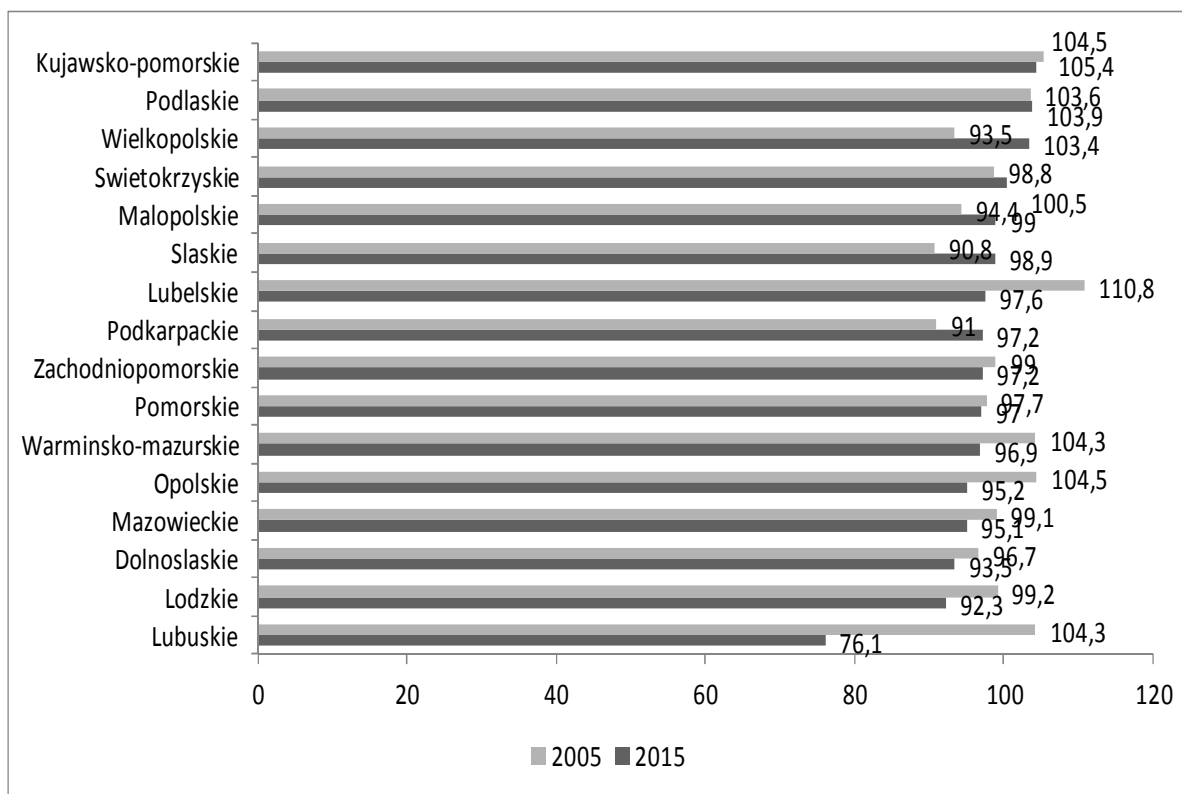
According to estimates by the European Commission, the population of dairy cows will decrease in 2015 by 0.3% in the European Union. In the old Member States trends may be different, and the number of cows may increase in the north-European countries (Ireland, the Netherlands, Denmark, Belgium, Germany), which have so far exceeded the limits and they face penalties for exceeding them, and have favourable natural conditions for milk production. Countries with less favourable conditions that underproduce their quotas are likely to reduce cow

populations (Italy, Greece, Spain, Portugal, Finland, Sweden, the United Kingdom) (Milk market, 2015).

Milk producers in the EU countries face different conditions. The increase of farms area led to increase of dairy efficiency in Hungary, Slovakia, the Czech Republic, Lithuania, Latvia and Estonia (Poczta W., Sadowski A., Sredzinska J., 2008).

Self-sufficiency of milk production varies across the EU countries. The Netherlands (140%), Poland (119%), Germany (115%) and France (114%) were the countries with the highest self-sufficiency of milk

production in the EU in 2007 on the one hand, while the self-sufficiency was the smallest in Italy (75%) and Great Britain (86%) on the other hand. Such diversification was the effect of specialization and concentration in the EU countries (Borawski P., 2015, Zekało M., 2015). Concentration led to the increasing production within a single economic unit (Runowski H., 2004, Wysokinski M., et al. 2015).

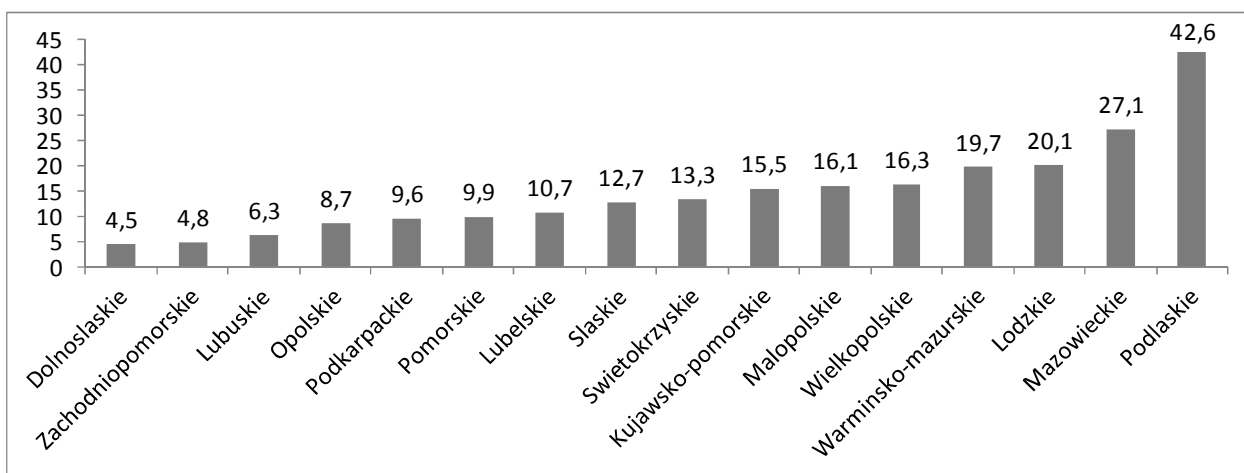


Source: author's construction based on Milk Market (State and Perspectives 2015)

Fig. 2. Rate changes of dairy cows herd in June 2004 and 2015 (June 2014 and 2004 = 100)

The average density of cows on 100 hectares farmland has declined by 0.2%. There was a slightly increased diversification of cow density per unit of surface (Figure 3). The province of Podlaskie has the highest cows density. After falling in 2014, average herd size grew by 0.4% to 42.6 cows/100 hectare of arable land. At the same time in the provinces with a density less than 8 dairy cows/100 ha of arable land (Dolnoslaskie, Zachodniopomorskie and Lubuskie), had cow density decrease by 0,1-1,3 units (Milk Market State and Perspective, 2015).

The regional differences in purchase prices of milk increased. During the 12 months from July 2014 to July 2015, the purchase price fell in all provinces, from 13.4% (Podlaskie) to 24.9% (Pomorskie) (Milk market, 2015). The price of milk increased in all provinces in the years 2005-2015 (Figure 4). The highest increases were in: Podkaprackie (35.3%), Malopolskie (30.8%), Lubelskie (23.5%) and Slaskie (22.1%) provinces. The lowest increase occurred in Kujawsko-pomorskie (6.1%), Zachodniopomorskie (10.7%), Pomorskie (11.3%) and Lodzkie provinces (11.6%).



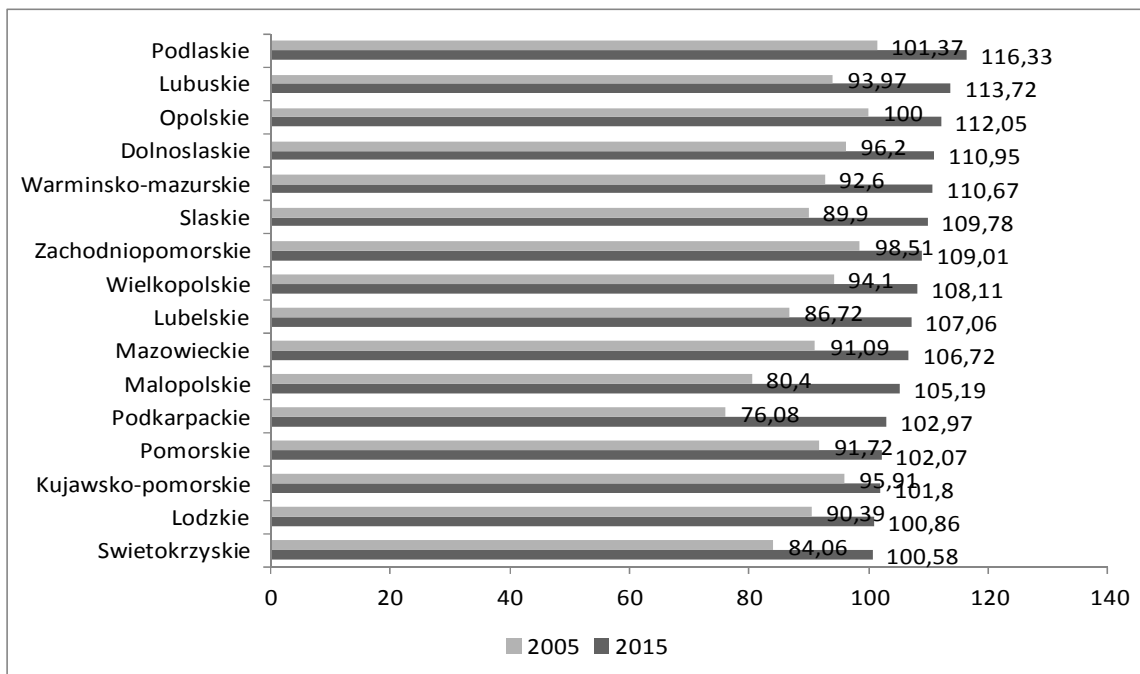
Source: author's construction based on Milk Market (State and Perspectives 2015)

Fig. 3. Density of dairy cows on 100 ha of arable land in June 2015

The price of raw milk also dropped in the European Union. Price began to decrease in January and continued to fall in 2015. But the average annual prices remained high because of the 2013 prices. Prices of raw milk in the EU-28 decreased 5.9% to 31.08 EUR/100 kg. in the first half of 2015 from December 2014 levels, with somewhat greater decreases in the EU-13 than the EU-15. In July and August, the fall in the price of raw milk has continued (Figure 4). Finally, from December 2014 to August 2015 prices of raw milk

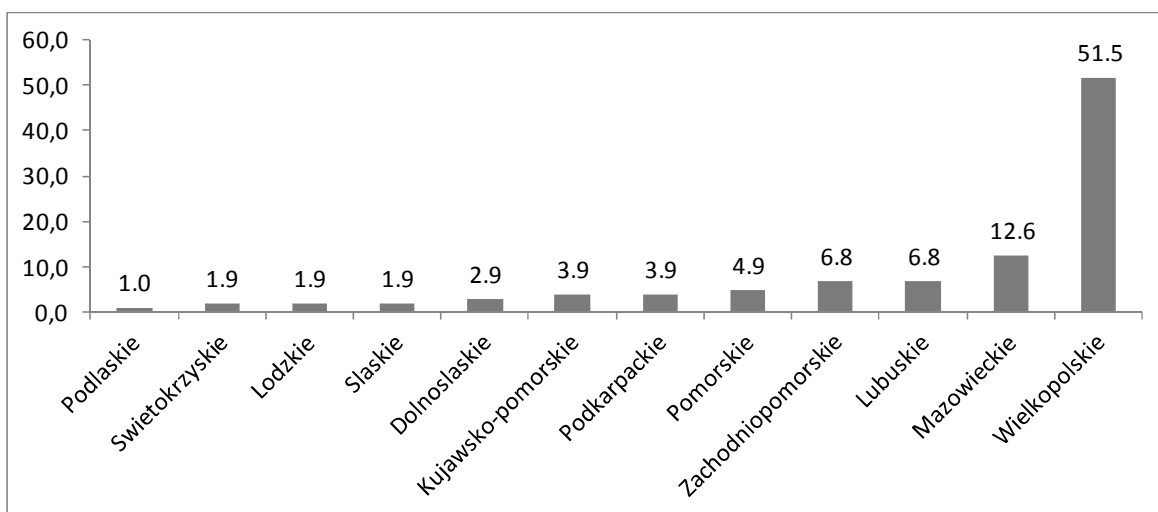
have declined on average in the EU-28 by 11.7%, with the EU-15 lower by 11% and the EU-13 prices lower by 16%. (Milk market, 2015).

An important factor in the development of milk production is the price at all points of the marketing chain. Price volatility creates uncertainty mainly for milk producers, but also for processors and customers. The relationship between prices in the marketing channel reflects the efficiency and the degree of market competition (Weldesentbet T., 2013).



Source: author's construction based on Milk Market (State and Perspective 2015)

Fig. 4. Purchase milk price in July 2005 and 2015 (by province)



Source: author's construction based on Milk Market (State and Perspective 2015)

Fig. 5. **The share of milk producers groups by region (as of 08.07.2015).**

An important factor of the development of milk production is the creation of producer groups. From the end of 2009, the number of producer groups of milk in Poland quadrupled to 103 in 2015, of which 52% in the Wielkopolskie province, with 900 members. In the region the number of milk producer groups more than seven times compared to 2009 (Figure 5). This may be the effect of this province's proximity to Germany and stronger international competition.

Mazowieckie province, in which farmers have the biggest share in production and procurement of milk, created 13% of all milk producer groups (more than tripled an increase in the analyzed period). In Podlaskie, which delivered 20% of the national milk procurement, only one group of milk producers operated, which brings together the largest number of members.

Seven percent of the milk producer groups worked in the provinces of Lubuskie and Zachodniopomorskie. In four provinces (Opolskie, Warminsko-Mazurskie, Lubelskie and Dolnoslaskie) no groups of dairy farmers operate (Milk market, 2015).

Conclusions

The dairy herd is diversified in Poland. Only four provinces in Poland increased their dairy herds in 2015 in comparison to 2014. These provinces were: Kujawsko-pomorskie (104.5), Podlaskie (103.9), Wielkopolskie (103.4) and Swietokrzyskie (100.5). The dairy herd increased in the years 2005-2015 in Kujawsko-pomorskie, Podlaskie, Wielkopolskie, Swietokrzyskie, Slaskie and Podkarpacie provinces.

The elimination of the quota system in 2014 had an effect on milk markets in Poland. The supply of milk in

Poland increased, and the price of milk decreased. Such solutions in the European Union had also an impact on milk consumption, which increased. It also forced both producers and the dairy industry to be more competitive.

The density of dairy cows on 100 ha of arable land varies in Poland. The four provinces with the highest cow density are: Podlaskie (42.6), Mazowieckie (27.1), Lodzkie (20.1) and Warminsko-Mazurskie (19.7). These regions have good conditions for milk production development including meadows and pastures.

The purchase price of milk is diversified in Poland, too. The three provinces with the highest purchase price of milk in Poland in 2015 were: Podlaskie (116.33 PLN/tonne), Opolskie (112.05) and Dolnoslaskie (110.95). The price of milk increased in the years 2005-2015. This was the effect of opening access to European markets, higher prices and higher demand for milk and dairy products.

The milk market is not well integrated and the process of integration varies widely regionally. The scale of milk production is not correlated with the integration process, because Podlaskie province, which is one of the biggest milk producers in Poland, has only one producer group, whereas Wielkopolskie province, which is also a big producer of milk in Poland, has got almost 52 producer groups.

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