CONCENTRATION OF MILK PRODUCTION IN POLAND

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Abstract. This paper presents selected issues related to the processes of concentration of commercial milk production in Poland. The analysis excludes farms that sell directly to individuals, due to their marginal share in total commercial production (less than 1%).

Changes in milk production in Poland as a whole and in individual regions have been analyzed dynamically in terms of quantities delivered, average quantity delivered per farm and number of suppliers. Based on the Gini coefficient, surveys released a steady process of concentrating milk production in certain Polish regions. The research has also shown notable changes in the structure of wholesale deliveries of milk and the structure of suppliers. Research let to observe the decided decrease in importance of producers selling less than 50,000 kg of milk per year in comparison with those selling more than 200,000 kg.

Key words: milk production, concentration of production, scale of production

JEL code: Q10

Introduction

Concentration, in most general terms, means intensification, the process of making denser or smaller (Slownik jezyka polskiego, 1988). Concentration of production in an agricultural farm, means nevertheless a process of intensifying (attracting, drawing together) production and the means necessary to achieve it within a separate, self-sufficient economic unit (Encyklopedia ekonomiczno-rolnicza, 1984).

The main aspects of concentration in agriculture include concentration of production (scale of production, cultivation, raising livestock) and spatial concentration while producing specific agricultural products (Zegar J.S., 2009).

According to Rychlik and Kosieradzki, references to concentration of production should be understood as covering a specific branch of production, group of products, or even a single product. Statistically speaking, concentration of production in agriculture refers mainly to the...
mass of a specific agricultural product available to the farm during the year (Rychlik T., Kosieradzki M., 1978).

In literature, assertions have also been made that the notion of concentration is frequently equated with the notion of scale of production. This is the result of a certain interdependence between concentration and scale of production; advances in one lead to increases in the other (Runowski H., 1994).

According to Wos and Tomczak, the scale of agricultural production can be understood not only in quantitative, however also organizational and economic terms. A specific scale of production involves a certain method of organization and economics of production and the consequent effectiveness of production (Wos A., Tomczak F., 1979).

The basic objective of business entities in agriculture is to improve the effectiveness of production with a view to increasing their income. As noted by H. Runowski (1994), every reasonably sized process of concentrating production has a positive impact on the effectiveness of manufacturing processes. An increased scale of production permits effective application of modern production technologies – the main source of economic advances in agriculture, the other being advances in biology – and thereby contributes to better farming effectiveness.

Following the microeconomic approach, the efficiency is its capacity to transform expenditures into effects, where a larger value of productivity indexes is indicative of a higher efficiency of a particular economic entity (Coelli et al., 2005; Lenort et al., 2014; Wysokinski et al., 2014).

Globalization and new technologies are conductive to the expansion of large farms. Globalization is also inherently associated with powerful food processing and retail corporations which show preference for larger agricultural farms either due to new requirements concerning the quality, timeliness and batch size of deliveries, or because of lower transaction costs (Birner R., Resnick D., 2005). Similarly, new capital-intensive technologies and biotechnological advances, as inventions of modern corporations, are more suitable to large agricultural farms, undermining the position and opportunities of family farms (Hazel P., Poulton C., Wiggins S., Dorward A., 2007).

The process of concentration also occurs in family (individual) farming, as evidenced by changes in agrarian structure. Observed trends include a decrease in the number of farms and concentration of land within steadily growing estates. Such transformations in Polish agriculture came, for multiple reasons, with delay compared to Western Europe countries, a fact of some importance considering the integration of the Polish food and agricultural sector into the EU Single Market and the application of the Common Agricultural Policy mechanisms (Zegar J. S., 2009).

Concentration of production is accompanied by organizational problems, such as inefficient logistics (Rokicki T., 2013; Baran J., Zak J., 2014).
Proceeding to the analysis of concentration of production on the milk market, one can share the assertion of H. Runowski that concentration of production means the process of increasing production within a single economic unit, while scale of production means a specific advanced stage of that process. Scale of production is a specific level of concentration of production (Runowski H., 1994).

**Research methodology and sources of materials**

The purpose of this study was to identify changes in wholesale milk production in Poland and to estimate the level of concentration in spatial terms.

Research tasks was to identify the level of concentration of wholesale milk production in Poland; to estimate the changes in the structure of supply and wholesale suppliers of milk in Poland; and to analyze the wholesale milk production in Poland on a regional basis.

The research focused on wholesale production due to its dominant role on the Polish market (accounting for more than 99% of total sales during the 2012/2013 quota year*). Using data from the Agricultural Market Agency (Milk Production Quota Office), a comparison was made between the structure of deliveries and suppliers in the quota years 2004/2005 and 2012/2013. The analysis was based on the following delivery ranges: A - (> 0 ≤ 20,000 kg per year); B - (> 20,000 ≤ 50,000); C - (> 50,000 ≤ 100,000); D - (> 100,000 ≤ 200,000); E - (> 200,000 ≤ 500,000); F - (> 500,000 ≤ 1,000,000); G - (> 1,000,000);

The study is based on the literature review method, the descriptive method, concentration measures (Gini coefficient, Lorenz curve).

Gini coefficient was used to assess the wholesale milk production concentration level. It is strictly linked with the Lorenz curve (hence its second name – "Lorenz concentration ratio"). Since it is the most commonly used inequality measure, it contains many formal representations. One of such representations is described below (1):

\[
G = \frac{1}{2\mu n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} \left| x_i - x_j \right|
\]

(1)

\[ \mu \] – average emission;

\[ n \] – sample size.

* EU milk production is limited. Each country can produce milk under quota. There are two types of milk production quotas: a) for sale directly from the farmer to the consumer, b) wholesale from the farmer for processing. Accounting and monitoring of production is within the quota year. Quota year begins on April 1 and ends on March 31. In Poland, the dominant role played by wholesale (more than 99% of the total amount of the national dairy market).
Gini coefficient of 0 expresses egalitarian distribution, while a Gini coefficient of 1 expresses maximal inequality. This equation may be interpreted as half of the absolute production difference between all countries in relation to average production. This coefficient satisfies the Pigou-Dalton Principle of Transfers (it changes by transferring production from high-production countries to lower-production countries) and principles of symmetry, homogeneity, replication. It does not, however, satisfy the decomposition principle.

The Lorenz curve illustrates accumulated percentage of wholesale milk production for subsequent countries in order from lowest to highest production. In a theoretical case, when production of all countries is equal, the Lorenz curve becomes a straight line at 45 degrees (curve of absolute equality). However, such situation does not actually occur. The greater the production diversity, the more the actual curve differs from the curve of absolute equality. The Gini coefficient is a quantitative measurement of this inequality, which equals 2 x the field between the actual curve and the curve of absolute equality. It may take values from 0 – absolute equality of production – to 1 – all production is accumulated in hands of one country (Golasa et al., 2014).

Source materials included book publications, journal articles, and statistical data from the Agricultural Market Agency, Central Statistical Office and Institute of Agricultural and Food Economics. The results of research have been presented in the form of tables and figures.

**Research results and discussion**

Poland is ranked as one of the largest producers of milk in the European Union. Together with Germany, France, the United Kingdom, the Netherlands and Italy, it accounts for 70% of wholesale delivery of milk, an evidence of strong concentration of commercial milk production in the EU. This is confirmed by a high Gini coefficient, which in 2013 was equal to 0.65. The Lorenz curve shows the cumulative percentage of the 2013 production, ranked from highest to lowest, in individual states (Figure 1). The larger the disparity between production values, the more the curve deviates from the line of equality.
Poland’s accession to the European Union was a major challenge for the milk industry. Circumstances imposed by the Common Agricultural Policy (compliance with production limits, competition on the unified European market, sanitary and veterinary requirements, increased production costs) served to stimulate the concentration of production and specialization and were the main factor behind the restructuring of the milk sector during the last ten years (Wilkin J., Milczarek D., Malak-Rawlikowska A., Falkowski J., 2007). Factors of importance in this process included, inter alia, better product quality, pre-accession support for investments, developing exports, rising prices of milk, introduction of direct subsidies, and the milk quota system. Since 2004, producing, organizational and economic circumstances have changed, resulting in altered behaviours of producers and processors.

In analyzed period during which milk quotas were in effect in Poland (milk production subject to limits envisaged in the CAP and imposed upon accession to the EU), the number of suppliers fell by around 55% (from 316,723 in 2004/2005 to 140,927 in 2012/2013). In each quota year, the number of suppliers decreased by 22,000 on average. This development was more intense in the years immediately following accession to the European Union. The largest decrease in the number of suppliers, over 40,000, was noted between 2006/2007 and 2007/2008. Since 2010, while the downward trend remained steady, the drops were not so pronounced.
The diminishing number of suppliers combined with growing wholesale production of milk means that the average delivery size has increased. Milk production became concentrated in farms that survived on the market. Between 2004 and 2013, the average size of wholesale deliveries to purchasing centres rose steadily, a quite positive sign that the market of milk producers is becoming concentrated (Figure 2).

In the 2012/2013 quota year, the average wholesale delivery to purchasing centres was about 150% larger than in the first year in which quotas were in effect. The average delivery figure rose by more than 5,000 kg per year. The growth dynamics increased year by year as well.

The milk market in Poland is also characterized by strong regional variation. A progressive concentration of production in spatial terms was observed, evidenced, *inter alia*, by the systematic increase of the Gini coefficient in the researched period (Figure 3). An upward trend for the Gini coefficient can be observed since 2004/2005. This means that the diversification of wholesale milk production in Poland is growing, suggesting that the largest producing regions are increasing their production, while others are decreasing it.

* As at the last day of each quota year
Parameters like production size, purchases of milk, milk yield per cow or concentration of production take different values in each region. The accession of Poland to the European Union and attempts to stay ahead of the changing market have further consolidated these differences. As it turned out, regional differences on the milk market (Seremak-Bulge J., 2006) are influenced by factors other than natural conditions, level of agricultural development, or agrarian structure (the strong ties between milk and land notwithstanding) (Wysokinski M. M., Dziwulski M., 2013). The establishment of accelerated milk processing centres, presence of strong processing entities, development of modern consulting, enterprises undertaken by farmers, appetite for risk, aid in the restructuring process (advisory centres) and use of the EU funds are some of the causes underlying the recent rise of milk production outside areas known for their superior natural and production conditions. The current changes in the milk industry run contrary to the common wisdom on agricultural development, according to which the Eastern regions of Poland are characterized by less intensive farming and lower production results. It is exactly these Eastern and Central Poland areas (for example Podlaskie and Mazovia regions) that stand out as strong milk producers, defying general agricultural development trends.

Regions with the largest production (Mazovia, Podlaskie, Wielkopolskie and Lodzkie) have delivered 60% and 64% of commercial milk in 2004/2005 and 2012/2013, respectively. Therefore, one fourth of Polish regions is accounting for more than 60% of milk deliveries to purchasing centres, a tendency that is still on the rise. In the analyzed period, production rose most strongly in Wielkopolskie (33%) and Podlaskie (32%) regions, with the average nationwide growth figure on the level of 18%. Above average results were also noted in Kuyavia-Pomerania, Mazovia and Warminsko-Mazurskie regions. The largest decrease in the number of suppliers was observed in the Lower Silesia and Podkarpackie regions, respectively by 74% and 72%. On average, the number of Polish producers subject to wholesale production limits decreased by 55% in the researched period. Opposite to this tendency, the average size of wholesale deliveries rose by 153%. The largest contribution to this figure came from the
Lower Silesia region (263%). In 2012/2013, the largest average wholesale deliveries were made in Westpomeranian (201,245 kg per year), Lubuskie (177,185) and Opolskie (154,938) regions, leading to the conclusion that these regions contain farms with the highest scale of production. Farms with the smallest average wholesale deliveries came from Podkarpackie (21,751 kg per year), Malopolskie (24,190) and Swietokrzyskie (28,780) regions.
<table>
<thead>
<tr>
<th>Region (voivodship)</th>
<th>2004/2005</th>
<th>2012/2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size of wholesale deliveries [kg]</td>
<td>Number of suppliers 31. 03. 2005</td>
</tr>
<tr>
<td>Podlaskie Region</td>
<td>1 500 606 335</td>
<td>33 006</td>
</tr>
<tr>
<td>Kuyavia - Pomerania</td>
<td>580 691 309</td>
<td>13 025</td>
</tr>
<tr>
<td>Pomerania Region</td>
<td>225 087 860</td>
<td>3 666</td>
</tr>
<tr>
<td>Lubuskie Region</td>
<td>91 605 305</td>
<td>1 531</td>
</tr>
<tr>
<td>Silesian Region</td>
<td>180 504 493</td>
<td>9 251</td>
</tr>
<tr>
<td>Swietokrzyskie Region</td>
<td>186 472 835</td>
<td>17 750</td>
</tr>
<tr>
<td>Malopolska Region</td>
<td>170 061 668</td>
<td>20 070</td>
</tr>
<tr>
<td>Lodz Region</td>
<td>742 571 168</td>
<td>42 994</td>
</tr>
<tr>
<td>Lubelskie Region</td>
<td>614 967 512</td>
<td>44 270</td>
</tr>
<tr>
<td>Warmińsko- Mazurskie Region</td>
<td>649 255 682</td>
<td>12 154</td>
</tr>
<tr>
<td>Opole Region</td>
<td>205 132 006</td>
<td>3 023</td>
</tr>
<tr>
<td>Wielkopolskie Region</td>
<td>1 057 632 936</td>
<td>16 820</td>
</tr>
<tr>
<td>Podkarpacie Region</td>
<td>128 725 552</td>
<td>17 695</td>
</tr>
<tr>
<td>Westpomeranian Region</td>
<td>134 248 469</td>
<td>1 787</td>
</tr>
<tr>
<td>Mazovia Region</td>
<td>1 713 611 746</td>
<td>69 825</td>
</tr>
<tr>
<td>Lower Silesia</td>
<td>165 427 931</td>
<td>4 246</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8 346 602 807</strong></td>
<td><strong>311 113</strong></td>
</tr>
</tbody>
</table>

Source: author’s calculations based on ARR data
To recognize the changes in the structure of wholesale milk deliveries and suppliers, it was proposed to subdivide all suppliers into seven ranges by delivery size.

In the period chosen for research, the importance of deliveries from each range clearly changed. Firstly, there was a drastic reduction in importance of deliveries originating from farms that output less than 50,000 kg of milk (their share falling from more than 41% in the 2004/2005 quota year to 17% in the 2012/2013 quota year). The share of farms delivering up to 20,000 kg of milk decreased from 18.47% to about 4%, a clear proof of marginal importance of this scale of deliveries in Poland.

Table 2

<table>
<thead>
<tr>
<th>Supply compartments (thousand kg)</th>
<th>Share of supply (%)</th>
<th>Share of suppliers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 0 ≤ 20</td>
<td>18.47</td>
<td>4.34</td>
</tr>
<tr>
<td>&gt; 20 ≤ 50</td>
<td>22.62</td>
<td>13.31</td>
</tr>
<tr>
<td>&gt; 50 ≤ 100</td>
<td>22.77</td>
<td>20.62</td>
</tr>
<tr>
<td>&gt; 100 ≤ 200</td>
<td>15.79</td>
<td>24.51</td>
</tr>
<tr>
<td>&gt; 200 ≤ 500</td>
<td>7.93</td>
<td>20.29</td>
</tr>
<tr>
<td>&gt; 500 ≤ 1000</td>
<td>2.89</td>
<td>6.41</td>
</tr>
<tr>
<td>&gt; 1000</td>
<td>9.53</td>
<td>10.51</td>
</tr>
</tbody>
</table>

Source: author’s calculations based on ARR data

Another observed tendency was the growing share of deliveries in ranges upwards of 100,000 kg (an increase from 36% to 60%). The largest contribution to this growth was definitely the increased share of deliveries in the 100,000 - 200,000 kg and 200,000 - 500,000 kg ranges in the total figure, a rise respectively from 16% to 24.51% and from 8% to 20%. Deliveries in the 50,000 - 100,000 kg range accounted for 20%-22% of the total figure, while deliveries in the 1,000,000+ kg range for about 10% of milk delivered for purchasing centres; these percentages holding steady in every year.

In the entire researched period, the share of producers in the up to 20,000 kg range decreased from 69% to 34%. In 2012/2013, while farmers delivering up to 50,000 kg per year accounted for 62% of all wholesale producers, they delivered only 18% of wholesale milk production in Poland. The average size of deliveries from farms, excluding those contributing less than 50,000 kg per year, would equal 149,000 kg, a figure similar to the average level of deliveries in the EU.

Conclusions

1. Surveys conducted showed the dynamic changes in the sectors wholesale milk producers in the period of 2004-2013. The number of wholesale suppliers fell by 55%, while the average size of deliveries rose by 150%. An increase in wholesale sales was noted in each quota year, leading to a belief that this form of sales will continue
growing in line with more intense concentration of production and the decreasing number of milk suppliers.

2. A steady growth of the level of concentration of wholesale milk production in spatial terms was observed in Poland. The differences between production of milk in individual regions are expanding. In particular, production becomes concentrated in a couple of regions (Mazowieckie, Podlaskie, Wielkopolskie and Lodzkie), while Southern and South-Eastern Poland is pushed to the margin.

3. It has been observed that farms selling less than 20,000 kg of milk per year are becoming steadily marginalized. Nevertheless, there was a sharp rise in the share of producers selling from 200,000 to 500,000 kg per year.

Bibliography:

1. Agencja Rynku Rolnego, pp. 1.


