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MEASURING OF THE HUNGARIAN DAIRY FARMS EFFICIENCY

POMIAR EFEKTYWNOŚCI WĘGIERSKICH PRODUCENTÓW MLEKA

Key words: dairy farms, efficiency, partial efficiency indicators, business economics, Hungary

Słowa kluczowe: gospodarstwa mleczne, wydajność, cząstkowe współczynniki efektywności, ekonomia biznesu, Wegry

JEL codes: Q12, Q13

Abstract. The general objective of my research was to explore the main indicators of the dairy sector in Hungary, and then define and systematize their efficiency and the factors relevant concerning dairy farms. Moreover, my objective is to introduce the most commonly used methods for measuring efficiency, which can explore hidden reserves within the sector. Based on the secondary database (FADN), I created a partial efficiency index system of economic efficiency in four main economic areas (capital, production costs, human resources, livestock) which were characterized by using dairy farms efficiency differences of different size, year and legal form categories. The model input variables comes from Hungarian FADN database. I confirmed that the used efficiency methods (partial indicators) for measuring complex efficiency level were higher in my sample in the case of the large-sized farms than the for small and medium-sized farms.

Introduction

Milk and milk products play an important role in human nutrition, thus milk production is an important issue in the global food supply chain, particularly in developing countries. Milk is one of the most valuable human staple foods of high nutrition value. Although many nutrients and vitamins are found in vegetables and can be produced synthetically as well, this type of animal protein is essential for a balanced diet.

The world milk production shows a continuous rising trend since 1961. In 2013 the world total fresh milk production was 635.5 million tonnes (FAOSTAT 2016). Since the introduction of milk quotas in 1984 the European Union (EU) production has stagnated around 149 million tonnes (EUROSTAT 2016). The milk quota system was introduced to stop over-production in Europe.

The biggest milk producer in the world is Europe (36-38%) including the European Union (25-27%). The second largest milk producer is the American continent (North-, Central-, South America and the Caribbean) which represents 28-29% of the total milk production in the world (FAOSTAT 2016). The biggest milk producer in the EU is Germany (19%), the second is France (16%), and the third is the United Kingdom (10%). The Netherlands and Hungary account for 7% and 1.22% of total EU production, respectively (FAOSTAT 2016). Currently, dairy farms in a given EU country are expected to be more or less competitive when compared to dairy farms in other countries. A reason for that is the quota system, which does not allow trading between countries, may protect farmers from international competition. The quota system abolished in 2015, this put pressure on less competitive farms in different countries. The issue of optimal use of resources becomes important.

As noted by Paul Bauer et al. [1998], policy makers are particularly interested in the potential impact of their decisions on performance of firms. A firm that is inefficient is wasting inputs because it does not produce the maximum attainable output, given the quantity of inputs used, and hence the possibility of reducing average costs. Irrespective of whether a developed or developing economy is under consideration, findings from the study of technical efficiency have far-reaching policy implications.

Studying farm efficiency and the potential sources of inefficiency are therefore important from a practical and a policy point of view. On the one hand, farmers could use this information to improve their performance. On the other hand, policymakers could use this knowledge to identify and target public interventions to improve farm productivity and farm income [Solís et al. 2009].

Based on these, in terms of the global nutrition supply it is essential to increase milk production efficiency in the future to meet the enormous dairy product demand of explosive population growth. In an economics and social point of view, increasing the efficiency level of the milk production is a highly important area of the European Union (EU) and Hungarian agriculture as well. In general, the efficiency is a very broad concept, it is necessary to define accurately what we mean by it, what factors influence it, what are the assessment indicators and what methods can be used to measure the efficiency of a single dairy farm. The question of efficiency should be a priority area for both the European Union and Hungarian dairy farms to ensure that a single dairy farm can also produce competitively and efficiently for the national and global markets in an economically, socially and ecologically sustainable way.

Oligopolistic Hungarian dairy processors show a price setting behaviour against the milk producers, who have to follow a price-taking behaviour in the market because of their low level of market concentration. If milk producers would like to increase their profitability, resulting almost exclusively from the preceding, the only way they can follow is to increase their efficiency level.

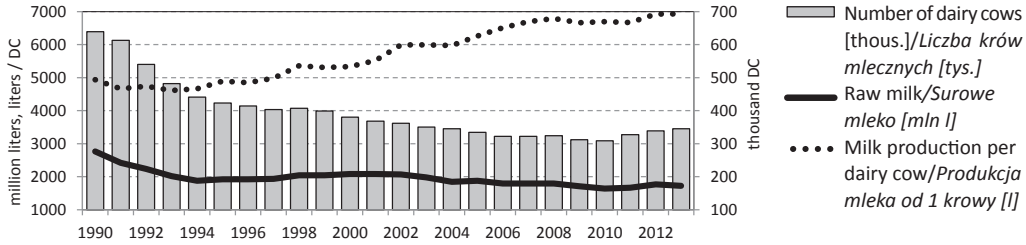


Figure 1. The main economic indicators of the Hungarian dairy sector (1990-2013)
Rysunek 1. Główne wskaźniki ekonomiczne węgierskiego sektora mleczarskiego (1990-2013)
Source: own calculation based on [KSH 2016]
Źródło: opracowanie własne na podstawie [KSH 2016]

Figure 1 introduce the main economic indicators of the Hungarian dairy sector from 1990 to 2013. The number of dairy cows (DC) are decreasing until 2010, but the sum of raw milk production is stagnate during this period. This happened, because the average dairy production per dairy cow index is increasing dramatically in this period, which stabilise the raw milk production trend over the decreasing dairy cow numbers in this periods. This fact indicate that the Hungarian dairy sectors efficiency is increasing, but this is only one but very important indicator from this sector.

Research material and methodology

To achieve my research objective, first the main indicators of the industry will be introduced, which will be explained in the first part of the literature section. The chapter where I introduce the Hungarian dairy sector production trends and indicators where mainly FAOSTAT, EUROSTAT, KSH (Hungarian Central Statistical Office) and AKI (Research Institute of Agricultural Economics) databases were used as sources. For my assessment, I will use the most reliable and comprehensive domestic agricultural economics database, the AKI-FADN database. In accordance with my objective, based on the database, a representative sample was selected in my analyses to represent the national dairy sector. The 104 608 data points were analysed in the model, which includes data from about 934 dairy farms in Hungary.

After the systematization of the collected data from the FADN database as possible model variables, I performed the data deflation and cleared the outlier values, then finally merged the

data from 2001 to 2013. After all, of this, I could start to filter the database in accordance with my categorization criteria, such as the creation of sub-databases with my categories. Such categorization criteria were:
– various years from 2001 to 2013;
– farm size (small, medium and large);
– legal form (individual- and corporate holding).

I developed a system of partial efficiencies and presented practical application of the different efficiency methods for dairy farms. In the section of partial efficiency, I examined 2 indicators, which are divided into 2 categories: capital efficiency, labour efficiency. I analysed the results of the partial efficiency indicators in each year separately, and for each the size categories and legal types of farming for thirteen years.

A number of partial efficiencies can be formed to compare economic and technological aspects of dairy farm efficiency. In the partial efficiency part of my research. To identify the partial efficiency indicators I used the following variables form the FADN database:
– cows' milk and milk products (values expressed in EUR in the database under the following code: SE216);
– production values: means the amount of milk- and milk products and the beef- and veal production, which will be added the industry related subsidies as well (values expressed in EUR in the database and can be calculated using the following codes: SE216 + SE220 + SE616 + SE617);
– milk yield average production of milk and milk products (in milk equivalents) per dairy cow (values expressed in kg/dairy cow/year in the database under the following code: SE215);
– annual milk production: the amount of milk and dairy products produced by a dairy farm in a year (values expressed in kg/holding/year in the database and can be calculated using the following codes: SE215 + SE085);
– total fixed assets: agricultural related land and buildings included, expressed in EUR, which is at the same facility permanently, or at least a prolonged period of economic activity, while production stock of only slightly or even not used up. In the FADN database under the following code: SE441;
– dairy cows: This category of European livestock units (LSU) contains female bovine animals on the farm, which are primarily kept for milk production. The European livestock unit of dairy cows is 1, and the calves younger than two years of between 0.4 and 0.6 take into account. In the FADN database under the following code: SE085;
– labour input: Time worked in hours by total labour input on holding. In the FADN database under the following code: SE011;
– total labour input: total labour input of holding expressed in annual work units = full-time person equivalents. In the FADN database under the following code: SE010.

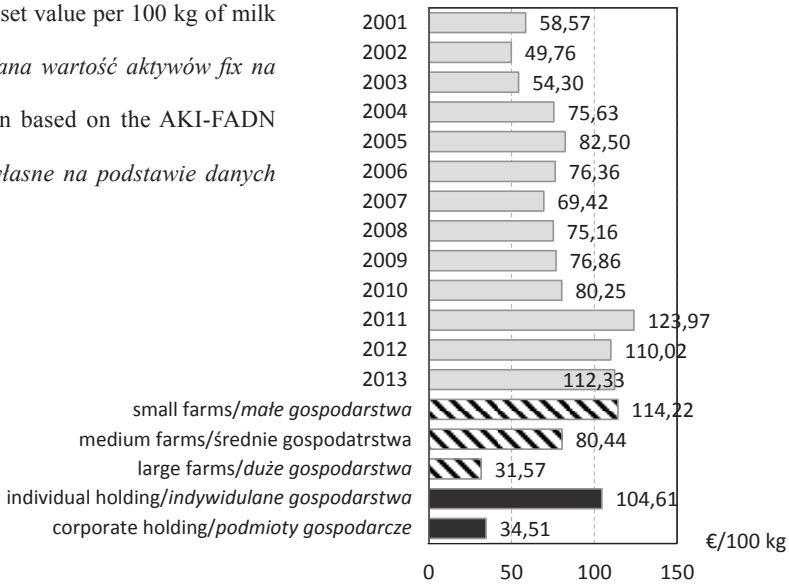
Straight and reverse indicators were also made for the partial efficiency indicators. First of all, results are available by using inputs and the single-unit expenses necessary to achieve the result indicators focused on milk production. Also, expenditures/expenditures and income/income related indicators were created.

Research results

Among the capital efficiency indicators I would like to emphasize the invested fix asset values per 100 kg of milk yield, according to that the average of the last thirteen years small farms 114.22 EUR invested fix asset per 100 kg of milk yield, which in the case of large farms 31.57 EUR/100 kg (Fig. 2). This ratio is valid for the case of individual and corporate holdings too, which suggests that in the domestic milk production generally individual farms are small farms, while large farms tend to operate as a corporate holding.

The indicator of hours to produce 100 kilograms of milk presents (Fig. 3) the superiority of large farms (3 hours/100 kg) compared to the small farms partial efficiency score (12,1 hours/100 kg).

Figure 2. Invested fix asset value per 100 kg of milk yield
Rysunek 2. Zainwestowana wartość aktywów fix na 100 kg mleka
Source: own calculation based on the AKI-FADN database
Źródło: opracowanie własne na podstawie danych AKI-FADN

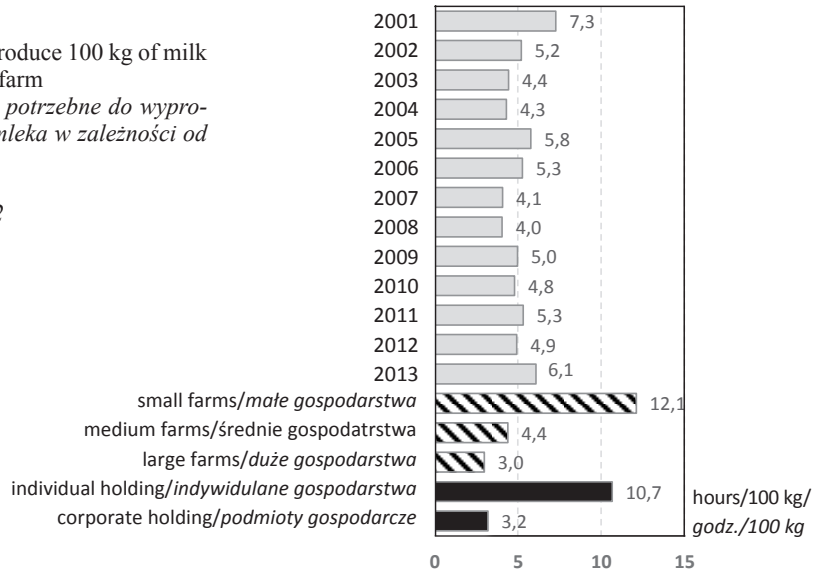


Among the cost efficiency indicators, the 100 EUR feeding cost per annual milk yield indicator can be the most important in the dairy sector. With 100 EUR of feeding cost, the large farms are able to produce 999.3 kg of milk, while the small farms only 879.2 kg of milk.

Among herd indicators, the production value per dairy cow indicators represents the best the differences among the different farm sizes and legal forms. This indicator also draws attention to the fact that that large farms produce the highest production value per dairy cow (1857 EUR/dairy cow) against small farms where the value of this indicator is 1337 EUR/dairy cow.

The two partial efficiency indicators also proved large farms' great advantage in efficiency scores against the small dairy farms. It can be concluded that the efficiency of the milk-producing small farms is below the level of efficiency of large farms. At the national level corporate dairy farms have higher efficiency scores than the individual dairy farms by 6%.

Figure 3. Hours to produce 100 kg of milk in depending of the farm
Rysunek 3. Godziny potrzebne do wyprodukowania 100 kg mleka w zależności od gospodarstwa
Source: see fig. 2
Źródło: jak na rys. 2



Summary and conclusions

1. Based on the secondary database (FADN), I created two partial efficiency indexes of economic efficiency in two economic areas (*capital, human resources*) which were characterized by using dairy farms efficiency differences of different size, year and legal form categories.
2. The reason why I chose this indicator is that the calculation of net income may differ from the large and small farms, which can bias the results. In the course of farm size comparison, the economies of scale advantages were dominating, just like over the examined period the large farms.
3. Based on the examined partial efficiency indicators, I cannot clearly determine whether farm size would influence the magnitude of efficiency regarding to the invested fixed assets and labour hours, so I could not confirm my hypothesis. It is necessary to carry out a deeper investigation in this area to explore the reserves of the dairy technologies.
4. The main proposals for development directions in the light of the efficiencies can include lower partial efficiency of small farms in the future, not to be allowed to compete with large-scale dairy farms in production; rather producing more specific milk contents to serve the needs of small size milk processing companies like higher fat and protein milk. In contrast with the primary purpose of large farms, their partial efficiency has to be increased to serve large industrial milk processing companies in the future and produce high amount of milk with low cost.

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Streszczenie

Na podstawie danych FADN dokonano oceny efektywności ekonomicznej gospodarstw mleczarskich na Węgrzech. Przedstawiono najczęściej stosowane metody pomiaru efektywności, które można stosować do oceny rezerw w tym sektorze. Określono system wskaźników efektywności ekonomicznej w czterech głównych obszarach gospodarczych (kapitał, koszty produkcji, zasoby ludzkie, zasoby zwierzęce). Użyto je do scharakteryzowania gospodarstw mlecznych pod względem różnej wielkości i formy prawnej. Stwierdzono, że przy zastosowaniu wskaźnika złożonego większą efektywnością charakteryzowały się gospodarstwa większe niż średnie lub mniejsze.

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