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THE ECONOMIC COMPARISON OF CAGE AND DEEP-LITTER SYSTEMS IN HUNGARY

PORÓWNANIE EKONOMICZNE SYSTEMÓW UTRZYMANIA KLATKOWEGO I NA GŁĘBOKIEJ ŚCIÓŁCE NA WĘGRZECH

Abstract. It is all the more difficult for the actors to hold their ground on the global market of caged egg production, that is why I believe it is important that the producers be able to judge their own competitivity, and bring their economic decisions based on this. However, the issue is raised whether the move towards alternative technologies indeed creates the opportunity of competitive management, so the aim of my research is the analysis of the economic relations of laying hen farms producing in different keeping technologies. There was no example in previous studies of a detailed economic comparison of the cage and deep-litter system from a national database in Hungary, so the cost-benefit analysis of these systems from Union accession to 2014 will lead to new scientific results.

Introduction

The egg is our essential food source, but its consumption has been decreasing continuously in Hungary since 1990. Consumption per capita fell by 27%, that is 78 pieces between 2004 and 2013. The size of our chicken stock has been fluctuating since our Union accession, and oscillates around 32 million. Within the aviary, however, the proportion of laying hens decreased. While almost half of the stock, 47% were laying hens in 2004, the stock of laying hens was only 38%, that is approximately of 12 million in 2015. The number of laying hens therefore decreased by 20% between 2004 and 2015 [KSH 2016]. BTT [2013] explained the reason of egg production decrease with the fact that customs tariffs ended with Union accession, so Union surplus would come freely to the Hungarian market in case of overproduction, consequently purchase prices decreased. Low purchase prices and high feed prices make the situation of producers more difficult, who in turn try to restrain introductions or bring chicken slaughter forward [Csorbai et al. 2011].

The European Council [EC 1999] determined already in its 1999/74/EC directive that keeping laying hens in unimproved cages would be prohibited from 1 January 2012. According to the directive, from 1 January 2012, it is forbidden to keep laying hens in traditional cages. At least 750 cm^2 of cage space has to be provided for laying hens in the improved cages instead of the previous 550 cm^2, and cages have to be furnished in a way to include a nest, litter they can peck and scratch, as well as a sitting perch at least 15 cm long for each hen. Although twelve and a half years passed between the publication of the directive and its implementation deadline, only 14 member states carried out the cage change as of 1 January 2012. 13 countries did not comply with the provisions by the set deadline, among them Hungary [EPIWCA 2013]. According to Katalin Aliczki [2012], the member states violating the provision did not change the cages on time because it required considerable investment. The producers who could not carry out the cage change until 1 January 2012, got a respite from the European Commission

until 31 July 2012 with the condition that eggs produced in traditional cages would be used only for industrial purposes. According to the European Union of Wholesale with Eggs, Egg Products, Poultry and Game, production in improved cages makes the prime costs of Union producers 12% more expensive, which means competitive disadvantage compared to imported eggs arriving from outside the Union, to which the EU animal welfare provisions do not apply [Kállay 2015]. Consequently, the producers consider animal welfare provisions to be competitive disadvantage, while a part of them prefers alternative technologies and is willing to comply with animal welfare requirements that are even stricter than improved cages.

Research material and methodology

I carried out the economic analysis of the cage and deep-litter systems based on the data of the Farm Accountancy Data Network. 91 laying hen farms took part in the Farm Accountancy Data Network in Hungary between 2004 and 2014, of these 49 produced in a cage, and 42 with a deep-litter system. No farm of the 49 cage system producers figured each year in the database. More than half of the farms provided data in one, two or three years. Among deep-litter laying hen system users, there were more producers who figured in the database for only one, two or three years. As the range of producers changed in both systems from year to year, no analysis could be elaborated that would have the same farmers each year. Data filtering was also made difficult by the fact that data came from different farm sizes as the range of data providers changed every year, so – with the exclusion of the largest and smallest farms – the number of farms that could have been analysed would have been reduced to one or two in certain years (fig. 1).

The size of the cage stocks was alternating between 6.911 and 17.653 laying hens, while the stock size of deep-litter farms was between 451 and 960 laying hens. 20% of the cage producers had less than 350 laying hens, 10% had between 351 and 1.000, and 43% had between 1.000 and 10.000. 26.5% of the farms kept more than 10.000 hens. 55% of deep-litter farms produced in a farm size of less than 350 hens, while these farms possessed less than 2% of total capacity. 14% of the farms produced with between 351 and 1.000 laying hens, while 26% had between 1.000 and 10.000 of them. There is one farm each in the database in the category between 10.000 and 25.000 laying hens and in the one above 25.000 laying hens.

When examining the data of the Farm Accountancy Data Network, I found that the prime cost of the egg depends greatly on the level of feed costs, so I found it necessary to examine it further. As in both keeping systems feed costs make up more than 50% of prime costs, one of my goal was to examine that what extent the change in the feed cost per egg affects egg prime costs. My first hypothesis was that: the Hungarian producers use little self-produced feed in both the cage and deep-litter system, so its cost-reducing effect on prime costs cannot
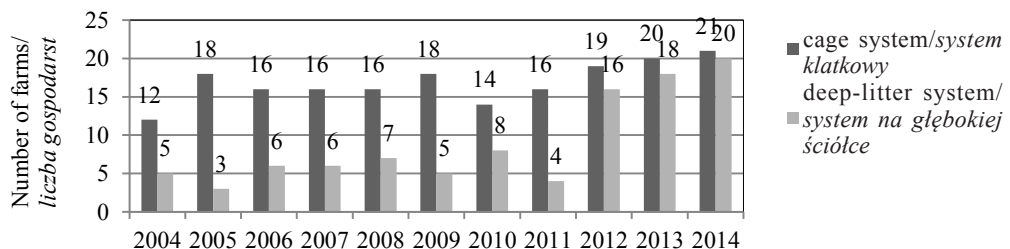

Figure 1. The number of responses that arrived per year (2004-2014)
Rysunek 1. Liczba odpowiedzi otrzymanych w ciągu roku (2004-2014)
Source: own calculation based on the data of the Farm Accountancy Data Network
Źródło: opracowanie własne na podstawie danych FADN

be demonstrated. My second goal was to reveal the cost-benefit differences of the examined keeping technologies. In general smaller farms sell eggs directly to the consumers, while larger producers are exposed to the prices set by multinational commercial chains, as a higher amount of merchandise can be sold on the market only via them. The same tendency is also typical of deep-litter producers. My second hypothesis was that: due to the low purchase price of the egg, the producers can increase their income primarily by cutting costs.

I revealed the relations and the parameters typical of the correlations between the following variables with the help of a correlation and regression calculation: feed costs and prime costs (HUF/egg), prime costs and average sales price (HUF/egg), prime costs and specific income (HUF/egg), average sales price and specific income (HUF/egg). I demonstrated the closeness of the correlations with the help of the Pearson correlation coefficient, and the direction and amount of the correlations with the regression coefficient.

Research results

First, I examined the correlation of the feed costs and prime costs in the cage system. I used correlation calculation to prove that there is a statistically verifiable correlation between feed costs and prime costs. The Pearson correlation coefficient showed strong positive correlation ($r = 0.775$). According to the value of the determinant coefficient ($r^2 = 0.601$), the regression equation accounts for 60.1% of the total distribution, that is the change in prime costs affects feed costs to 60.1%. According to the regression line, if the feed cost per egg is increased by 1 HUF, prime costs are expected to increase costs on average by 1.142 HUF (fig. 2). In the case of deep-litter keeping, I also examined how the prime costs of deep-litter eggs change in accordance with the cost of feed per egg. There is a strong positive link between the prime cost of deep-litter eggs and feed costs ($r = 0.755$). The regression equation explains 57% of total distribution ($r^2 = 0.570$), which means the change of feed costs affects the change of the prime costs of deep-litter eggs up to 57%. Based on the parameters of the equation, it can be affirmed that prime costs in deep-litter keeping change on the average by 1.338 HUF if feed costs per egg increase by 1 HUF (fig. 3). No statisti-
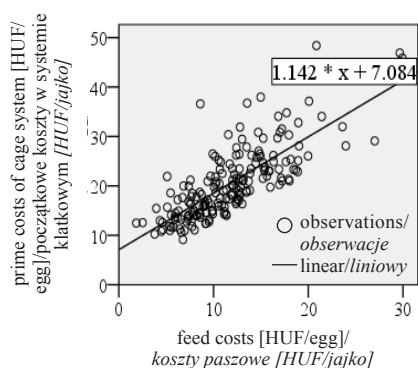

Figure 2. The regression of feed costs and own costs in cage system keeping
Rysunek 2. Regresja kosztów produkcji paszy i kosztów własnych w utrzymaniu systemem klatkowym
Source: own calculation based on the data of the Farm Accountancy Data Network
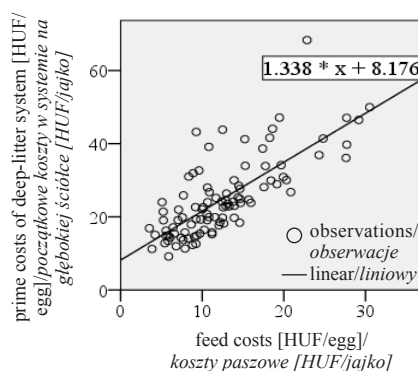*Źródło: opracowanie własne na podstawie danych FADN*

Figure 3. The regression of feed costs and prime costs in the case of deep-litter system
Rysunek 3. Regresja kosztów produkcji paszy i kosztów wyjściowych w przypadku systemu na głębokiej ściółce
Source: own calculation based on the data of the Farm Accountancy Data Network
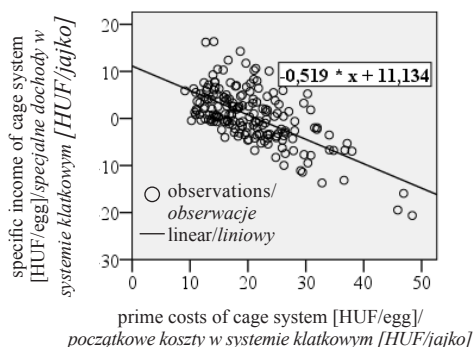*Źródło: opracowanie własne na podstawie danych FADN*

Figure 4. The regression of the prime cost and the specific income of cage system eggs
Rysunek 4. Regresja pierwotnego kosztu i dodatkowy dochód jajek z systemu klatkowego
Source: own calculation based on the data of the Farm Accountancy Data Network
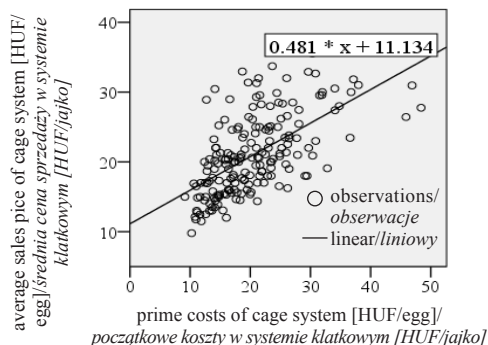*Źródło: opracowanie własne na podstawie danych FADN*

Figure 5. The regression of the prime costs and sales price of cage system eggs
Rysunek 5. Regresja kosztów wyjściowych i cen sprzedaży jajek z systemu klatkowego
Source: own calculation based on the data of the Farm Accountancy Data Network
Źródło: opracowanie własne na podstawie danych FADN

cally confirmable link could be proven between own feed and prime costs either in the case of the cage or the deep-litter system, therefore it cannot be confirmed that the usage of own feed would affect prime costs.

Next I examined how specific income changes in accordance with the changes that come about in the prime costs of cage system eggs. Based on the Pearson correlation coefficient I found that there is a medium strong negative correlation ($r = -0.638$) between the two variables. The regression line of the linear model explains 40.7% of the total distribution. Based on the regression equation, it can be stated that provided the prime cost of cage system eggs increases by 1 HUF, its specific income per egg is expected to decrease by an average 0.519 HUF (fig. 4).
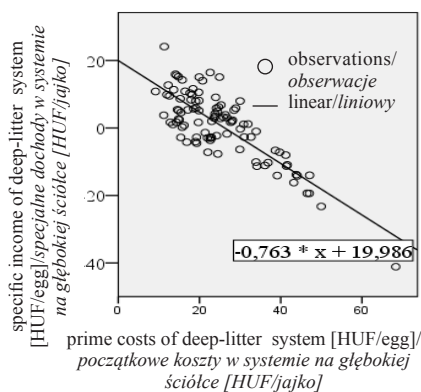
Next I examined the correlation between the average sales price and specific income in cage systems. According to the Pearson correlation coefficient, there is a weak correlation between the sales price and specific income ($r = 0.223$). The determination coefficient only accounts for 5% of total distribution, so I found that the change of the sales price does not have a significant role in the change of the specific income of the cage system egg. Examining the correlation between the prime cost of the cage system egg and its sales price, it can be stated that based on the Pearson correlation coefficient the medium strong positive correlation ($r = 0.609$) can statistically be confirmed. The regression line accounts for 37% of total distribution, so the line fits less into the set of points than in the case of previous equations. Based on the regression equation, it can be stated that provided the prime cost of the cage system egg increases by 1

Figure 6. The regression of the prime costs and specific income of deep-litter system
Rysunek 6. Regresja kosztów pierwotnych i dodatkowych dochodów z systemu na głębokiej ściółce
Source: own calculation based on the data of the Farm Accountancy Data Network
Źródło: opracowanie własne na podstawie danych FADN

HUF, its sales price is expected to grow by an average 0.481 HUF (fig. 5). This means that 1 HUF extra cost of the farm producing with the same efficiency is followed by a 0.48 HUF increase.

On the whole it can be stated that specific income is determined by costs rather than sales price. The sales price increases together with the increase of the costs, but to a lesser extent than prime costs, so producers can only increase their profit if they cut costs. The Pearson correlation coefficient indicated a strong negative correlation ($r = -0.813$) between the prime costs of deep-litter eggs and their specific income. The regression line accounts for 66% of the total distribution. According to the estimate of the equation, if the prime cost of the deep-litter egg increases by 1 HUF, then its specific income is expected to decrease by an average of 0.763 HUF (fig. 6).

Similarly to the cage system, in the case of the deep-litter system I also found a weak correlation ($r = 0.212$) between the specific income of the egg and its sales price. The regression line only accounts for 4.5% of total distribution, so I found that the change of the sales price did not play a determining role in the change of the specific income of deep-litter eggs.

Based on the Pearson correlation coefficient, there is a medium positive correlation ($r = 0.389$) between the sales price of deep-litter eggs and their prime costs. The regression line, however, only accounts for 15.8% of total distribution, which means the regression estimate provides an inaccurate value, it is unable to estimate the value of the changing variable. So the change of the prime costs of deep-litter eggs plays a small role in the determination of the sales price. This result can be explained by the fact that the data have a wide distribution.

Summary and conclusions

I demonstrated with correlation and regression calculation that there is a strong significant positive correlation between feed costs and flat costs in the case of both the cage ($r = 0.775$) and the deep-litter system ($r = 0.755$), whereas there is no statistically provable correlation between self-produced feed and flat costs, so I consider my first hypothesis to be confirmed. The use of self-produced feed decreased significantly in the case of the cage system since Union accession, while its rate stayed low all the time in terms of the deep-litter system. The low-rate use of self-produced feed can be explained primarily with the separation of crop production and animal husbandry.

I found a very significant negative correlation both in the case of the cage ($r = -0.638$) and the deep-litter system ($r = -0.813$) between the flat costs of the egg and its specific income, while I only came across a weak correlation between the average sales price of the egg and its specific income. This confirms that average sales prices change at such a slow pace that the effect price change has on specific income is not significant, so my second hypothesis is confirmed. For the time being, purchase prices do not recognize the higher cost level of furnished cages, and the market did not even compensate the investments spent on cage replacement via sales prices.

As a consequence of cage replacements, the proportion of the deep-litter systems increased in Hungary (30% in 2012), but was driven into the background in 2016 (20%) and 78% of production is still carried out in improved cages. The investments spent on cage replacement increased the amount of outgivings significantly, so adaptation caused Hungarian producers difficulties. The differences in efficiency experienced in the previous years grew and the concentrated character of the sector kept increasing. The natural efficiency indicators of Hungarian production fall behind the results of the largest and most efficient egg producing EU countries both in terms of feed conversion ratio and mortality. My correlation analysis indicates that feed cost influences prime costs both for the cage and the deep-litter system, and as it is primarily prime costs and not sales price that has a decisive effect on specific income, competitivity can mostly be increased by reducing prime costs.

Compliance with animal welfare provisions also leads to an increase in costs, which means competitive disadvantage compared to the countries that have more lenient or no animal welfare provisions than in the European Union. The cost increase can be counterbalanced by improving

production indicators, that is why the improvement of genetical abilities (longer persistence, bigger egg yield), better feed conversion ratio and reducing animal mortality continues to be important. One of the largest egg exporters to Hungary, Poland produces with a lower prime cost level – also due to better natural efficiency indicators – which gave it competitive advantage on the world egg market.

An important condition for the survival of the smaller, not effective producers is the higher obtainable price when selling directly to the consumer. Hungarian producers prefer placing the consumption of national products into the foreground, which precedes animal welfare or keeping system choice in terms of buyers' preference. More than 40% of the total amount of produced eggs gets to the consumers via the direct sales chains, meaning that the short supply chains have an important role. This opportunity primalarly can help for the deep-litter keepers because the average farm-size of them is smaller than in the cage systems.

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Streszczenie

Dokonano analizy ekonomicznej korzyści i kosztów systemów utrzymania drobiu bazujących na chowie klatkowym oraz na głębokiej ściółce. Badanie przeprowadzono na podstawie danych FADN z 2014 roku dla Węgier. Stwierdzono, że dodatkowe nakłady zmierzające do poprawy dobrostanu zwierząt nie są kompensowane przez rynek.

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