ROCZNIKI NAUKOWE STOWARZYSZENIA EKONOMISTÓW ROLNICTWA i AGROBIZNESU
doi: 10.5604/01.3001.0011.7241 **Roczniki Naukowe SERIA • 2018 • XX (1)**

received: 15.02.2018 acceptance: 29.03.2018 published: 04.04.2018

Virág Szabó

Szent István University, Hungary

RELATION BETWEEN FARM SIZE AND ECONOMIC EFFICIENCY IN HUNGARIAN EGG PRODUCTION

ZALEŻNOŚĆ MIĘDZY WIELKOŚCIĄ FERM KURZYCH NA WĘGRZECH I ICH WYDAJNOŚCIĄ EKONOMICZNĄ W PRODUKCJI JAJ

Key words: cage system, deep-litter system, unit cost, labour cost, sales price

Słowa kluczowe: system klatkowy, system na głębokiej ściółce, koszty jednostkowe, koszty pracy, cena sprzedaży

JEL codes: Q120

Abstract. The economic efficiency of cage and deep-litter farms of different sizes with a cost and income analysis based was examined on the 2004-2014 Farm Accountancy Data Network (FADN) data provided by the Hungarian Research Institute of Agricultural Economics (AKI). It was found that the differences in efficiency experienced in previous years continued to increase years after the cage changes in both types of hen keeping appeared. It has been shown that deep-litter farmers typically keep smaller stocks and 36% of stocks are supplied in the framework of family work, whose wages are not recorded as personal expenses. It was also found that both unit cost and average sales price per egg decrease in the case of the cage and the deep-litter method with the increase in farm size. While the second biggest decline in average sales price occurs in the case of cage farmers with a stock of over 25,000, in the case of deep-litter farmers it already comes about at a stock of over 10,000.

Introduction

There were 551 laying hen farms in Hungary in 2011, 562 in 2012, 627 in 2014 and 935 in 2016 registered by the National Food Chain Safety Office (NÉBIH). Over the last five years, the number of laying hens increased by more than one and a half times, mainly due to the increase of the number of farms with less than 350 laying hens, from 140 to 384. In 2012, 25% of all farms kept less than 350 hens, but in 2016, 41% of the farms produced with this farm size. The number of farms with 351-1000 hens also grew one and a half times, so in 2016, 57.5% of the colonies produced with this farm size. 31.5% of the farms have a stock of 1000-10000, that is 89% of the farms have less than 10000 hens and only 11% of the farms keep more than 10000 laying hens.

The size of the full capacity of laying hen keepers increased minimally (by 4%), as the increase in the number of small farms did not imply a significant stock growth. According to the data of National Food Chain Safety Office [NÉBIH 2016], more than half of the farms, that is farmers keeping less than 1000 hens make up 3% of the total Hungarian capacity, while farmers with more than 10000 hens represent 11% of all farms, covering 80% of the full capacity.

In 2011, 43% of the stock was still produced with the traditional method, and 44% of the cages were already upgraded, so the cage stock made up 87% of the total stock [Molnár 2012]. According to data from National Food Chain Safety Office [NÉBIH 2016], in 2012, farmers shifted towards alternative technologies, more precisely they preferred deep-litter technology. This, however, was in most cases not due to market reasons, but to delaying investments. The rate of improved caged stock was the same (64%) in 2014 as in 2012, but in 2016 it already grew to 78%, while the deep-litter stock decreased to 20%, so some of the temporary deep-litter

farms returned to cage technology. Free keeping ranged from 4 to 7% between 2012 and 2016 in terms of farm number, but it shows that these farms kept small stocks, as the total number of free range hens was 1.5% of the total stock in 2016. The rate of organic keeping is even smaller, it makes up less than 1% of the domestic stock.

Research material and methodology

The aim of my research was to find the efficiency differences in the cage and deep-litter systems in the different farm size. The economic indicators were calculated based on the methodology used by the Hungarian Research Institute of Agricultural Economics [AKI 2013] for cost and income analysis. When examining differences in efficiency, the value of median costs of each year was also determined based on the AKI method [Béládi, Kertész 2013]. The median cost is made up of producers whose unit cost falls to within ±10% of the average unit cost. The average of those "better than the median" is made up of producers whose unit cost is more favorable than the median, while the average of those "worse than the median" consists of producers whose unit cost is less favorable than the median [Udovecz et al. 2006].

The economic analysis of the cage and deep-litter systems was carried out based on the data of the Hungarian Farm Accountancy Data Network (FADN) between 2004 and 2014. 91 laying hen farms took part in the FADN system in this period, of these 49 produced in a cage, and 42 with a deep-litter system. The size of the cage stocks ranged from 6911 and 17653 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 1000, and 43% had between 1000 and 10000. 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 1000 and 10000 of them. There is one farm each in the database in the category between 10000 and 25000 laying hens and in the one above 25.000 laying hens.

Research results

During my research, it was found that similarly to the cage method, there are differences in efficiency between the producers that prefer the deep-litter method. Until 2011, the same trend was observed as for cage producers, with a difference of an average 6-13 HUF between those better than the median and the ones worse than the median, but in 2012 and 2013 the difference between the two groups doubled in the case of the cage method, and more than doubled with deep-litter farmers (tab. 1). Unit cost difference between deep-litter producers was highest in 2013, there were examples of 48 HUF needed to produce an egg. Between 2012 and 2014, 61% of the deep-litter farms kept less than 350 hens, so the unit cost of farms that performed worse, that is less than the median, increased significantly. By 2014, the distribution of the unit cost of deep-litter producers decreased but there was still a difference of 18 HUF between the unit cost of those worse than the median and the ones that were better. The increase in the cost of the deep-litter producers can be explained by the large drop in the number of eggs per hen, resulting from weaker production results of the smaller farms.

Examining labour costs, it was found out that contrary to literature data, the labour costs of producing deep-litter eggs was higher only in four years out of the examined eleven (fig. 1). Compared to the previous years, in 2013 and 2014, the labour costs per deep-litter egg did not increase significantly because egg production per hen decreased to a huge extent.

According to Damme's [2011, referred to by: Horn 2013] data measured in Germany, compared to traditional caged keeping, FTE (full-time equivalent) is twice as high in aviaries, three times as high in the deep-litter system and four times as high in the free range system. As I did not demonstrate this kind of labour cost per egg, I calculated the number of work hours per hen and also the labour cost per work hour. In accordance with Damme's [2011] calculation,

Table 1. Analysis of the unit cost in the different efficiency cage and deep-litter farms (2004-2014)
Tabela 1. Analiza kosztów jednostkowych na fermach stosujących chów w systemie klatkowym i na głębokiej ściółce, wykazujących różną wydajność (2004-2014)

Year/ *Rok*	Better than the median unit cost [HUF/egg]/*Powyżej mediany kosztów jednostkowych [HUF/jajo]*		Median unit cost [HUF/egg]/ *Mediana kosztów jednostkowych [HUF/jajo]*		Worse than the median unit cost [HUF/egg]/*Poniżej mediany kosztów jednostkowych [HUF/jajo]*		Scatter of unit cost [HUF/egg]/ *Rozrzut kosztów jednostkowych [HUF/jajo]*	
	cage/ *klatka*	deep-litter/ *głęboka ściółka*	cage/ *klatka*	deep-litter/ *głęboka ściółka*	cage/ *klatka*	deep-litter/ *głęboka ściółka*	cage/ klatka	deep-litter/ *głęboka ściółka*
2004	11.50	-	14.31	15.57	17.38	19.31	2.841	1.876
2005	11.21	11.21	14.71	15.06	18.94	22.06	3.606	5.499
2006	12.86	17.22	16.06	22.50	19.99	24.52	3.470	3.310
2007	12.90	14.46	17.76	19.80	26.37	25.14	5.834	6.583
2008	14.88	12.67	18.80	15.82	25.20	22.45	5.023	4.986
2009	13.63	13.61	19.70	21.39	23.78	26.92	4.635	6.818
2010	17.01	12.98	22.16	19.02	28.76	25.47	5.154	4.807
2011	16.24	13.47	22.45	16.05	28.93	18.64	5.224	3.094
2012	16.43	15.73	25.24	25.09	31.70	33.51	6.998	8.457
2013	20.58	22.50	26.26	34.13	40.92	47.97	9.727	14.076
2014	16.52	23.66	23.68	31.50	31.58	41.97	7.518	8.606

Source: own calculation based on the data of the Farm Accountancy Data Network
Źródło: obliczenia własne na podstawie danych FADN

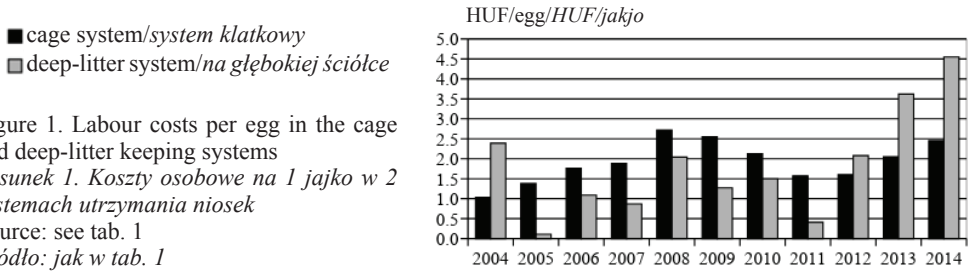

Figure 1. Labour costs per egg in the cage and deep-litter keeping systems
Rysunek 1. Koszty osobowe na 1 jajko w 2 systemach utrzymania niosek
Source: see tab. 1
Źródło: jak w tab. 1

I found that FTE was three times higher in the deep-litter system per hen, which means the statements found in literature were confirmed. A yearly average of 33 minutes is dedicated to a hen in the cage system, while in the deep-litter system it is 91 minutes (tab. 2). These values differ significantly from the German data, as in that case the yearly work time spent on a hen is 5 minutes in traditional cages, 10 minutes in aviaries, 16 minutes in the case of the deep-litter system, and 22 minutes if it is the free range system.

With regard to cost analysis, it was stated that labour costs per egg increased on average by 0.5 HUF in 2013 and 2014 compared to traditional caged keeping. Apart from the increase in salaries, the reason for the growth of labour costs was also the higher need of FTE. Compared to the average of previous years, between 2010 and 2012 the number of work hours per hen decreased, the reason for which can be more efficient production, but this tendency came to a halt with the introduction of furnished cages, as the number of hens per space unit decreased. FTE per hen is three times higher in the deep-litter system, but this cannot demonstrated either in net or gross labour costs (tab. 2).

Table 2. Work hour per hen, net and gross labour costs per work hour (2004-2014)
Tabela 2. Liczba godzin pracy, koszty za godzinę pracy i podatki (2004-2014)

Year/ *Rok*	Work hour per hen [hour]/ *Liczba godzin pracy na 1nioskę*		Net labour cost per work hour [HUF/hour]/*Średni koszt 1 godz. pracy [HUF/godz.]*		Gross labour cost per work hour [HUF/hour]/*Koszt 1 godz. pracy z podatkiem [HUF/godz.]*	
	cage/ *klatka*	deep-litter/ *głęboka ściółka*	cage/*klatka*	deep-litter/ *głęboka ściółka*	cage/*klatka*	deep-litter/ *głęboka ściółka*
2004	0.53	0.76	370.17	894.41	486.60	993.44
2005	0.54	2.43	477.95	0.00	609.29	15.20
2006	0.65	0.30	513.74	564.20	651.90	765.83
2007	0.57	1.45	592.98	118.16	738.56	155.97
2008	0.84	2.07	550.11	210.61	718.16	297.84
2009	0.77	1.54	576.54	189.75	747.43	251.95
2010	0.40	1.58	890.07	241.85	1 149.94	307.15
2011	0.43	1.30	752.88	72.64	974.53	91.90
2012	0.42	1.65	780.89	272.07	987.45	346.75
2013	0.45	1.86	817.68	321.79	1 028.46	409.48
2014	0.51	1.81	870.47	388.75	1 107.91	489.71

Source: see tab. 1
Źródło: jak w tab. 1

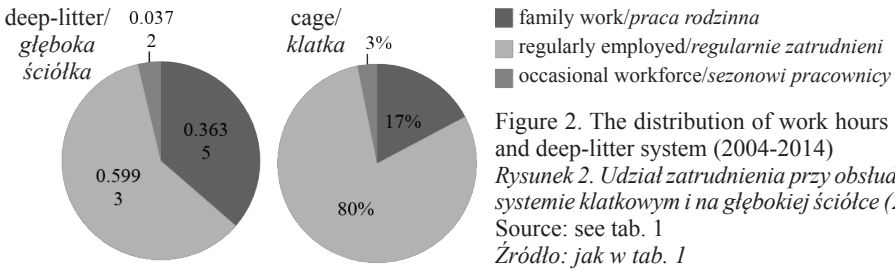

Figure 2. The distribution of work hours in the cage and deep-litter system (2004-2014)
Rysunek 2. Udział zatrudnienia przy obsłudze niosek w systemie klatkowym i na głębokiej ściółce (2004-2014)
Source: see tab. 1
Źródło: jak w tab. 1

Examining this background all the work hours were divided in both systems according to the number of work hours for the regularly employed people, occasional workforce and family work (fig. 2).

The proportion of family work is twice higher in the deep-litter system, 36% of the total working hours is carried out by family members. As the average size of deep-litter producers is smaller than that of cage system producers, therefore in spite of a bigger need for work, the stocks can be provided for by less staff. Apart from this, producers do not include labour costs for the work of family members, and primary producers often – especially if stocks are smaller – carry out their agricultural activity as a secondary job, therefore they do not pay themselves salaries or contribution. The lower labour costs of the deep-litter system are therefore due to the fact that the cost of family work does not appear in the costs for paid working hours. As the company form of the farms does not appear in the database at my disposal, the opportunity to compare collective and individual farms could not be carried out.

When comparing the two keeping systems, it can be stated that unit costs were identical in both keeping systems in the case of farms smaller than 350, so the keeping system did not affect costs in these farms. The differences in unit costs were highest among the plants between 350-1000, as cage system producers produced the egg 8 HUF cheaper in this size category. In the case of the stocks between 1000 and 10000, the production cost of the deep-litter egg was 2.32 HUF more expensive, while with stocks between 10000 and 25000, the extra expense was of 3.61 HUF (tab. 3).

Table 3. Average unit cost and the average sales price of the cage and deep-litter egg depending on farm size (2004-2014)
Tabela 3.. Średni koszt jednostkowy i średnia cena sprzedaży jaj od niosek utrzymywanych w klatkach i na głębokiej ściółce, w zależności od wielkości stada (2004-2014)

Farm size [hen]/ *Wielkość stada [szt.]*	Average stock [hen]/ *Średnia wielkość stada [szt.]*		Average unit cost [HUF/egg]/*Średni koszt jednostkowy [HUF/jajko]*		Average sales price [HUF/egg]/*Średnia cena sprzedaży [HUF/jajko]*	
	cage/ *klatka*	deep-litter/ *głęboka ściółka*	cage/ *klatka*	deep-litter/ *głęboka ściółka*	cage/ *klatka*	deep-litter/ *głęboka ściółka*
Under/*Poniżej* 350	168	134	29.96	29.90	28.34	28.10
350-1 000	672	680	18.26	26.20	21.19	24.04
1 001-10 000	3 198	1 714	19.58	21.90	19.66	23.81
10 001-25 000	13 086	14 038	18.97	22.58	21.45	19.58
25 001-50 000	32 800	-	14.38	-	15.99	-
50 001-100 000	54 319	-	13.65	-	17.24	-
Above/*Powyżej* 100 000	158 326	133 342	14.01	17.36	15.87	13.69

Source: see tab. 1
Źródło: jak w tab. 1

No data arrived from deep-litter system producers for the next two farm sizes, so the next category was producers above 100000, but the data of only one farm were available here, where the unit costs of deep-litter eggs was 3.32 HUF higher. Above 350, deep-litter producers could decrease their costs by an average 4 HUF, above 1000 it was further 4 HUF. The difference was of 0.5 HUF in the case of the farms between 1000 and 10000, as well as 10.000 and 25.000, so no further cost decrease could be demonstrated here, but the farm above 100.000 decreased its costs by further 4.5 HUF.

Based on the average sales prices corresponding to each farm category it can be stated that both keeping systems sold eggs at the highest prices in the case of farms below 350. In the case of cage system producers, the sales price also decreased significantly in two steps, similarly to unit costs. The first bigger decrease came about in the case of producers above 350, and the second in the case of farms above 25000, which could sell their eggs only at half the price as farms under 350 hens. This is due to the fact that while smaller farms sell directly to the consumers, 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, with the difference that the second big plummeting of the average sales price does not come about in the case of producers above 25000, but already with stocks of more than 10000.

Summary and conclusions

During my research, it was found that the differences in economic efficiency between the cage and the deep-litter producers are considerable in Hungary, what is more the differences in efficiency increased further in the years following cage change. It has been shown that unit cost decreases both in the case of the cage and the deep-litter method with the increase of farm size. Naturally, economic efficiency is also influenced by the technological efficiency indicators but it has not been found available information from FADN database.

FTE per hen is three times higher in the case of deep-litter keeping, but in Hungary this cannot be shown in labour costs per hen in terms of the sample, because due to the smaller average farm size of the deep-litter system 36% of the total working hours is carried out by the family. The rate of family work was two times higher in deep-litter keeping than in the case of the cage system. So the lower labour costs of the deep-litter system is due to the fact that the costs of family work do not appear in the costs paid for one working hour.

The average sales price was also calculated for each farm category apart from unit cost, which clearly shows that the farms with less than 350 hens sold the eggs at the highest price in the case of either method. Similarly to the unit cost, the sales price also decreases with the increase in farm size. Based on consumption statistics, however, consumers pay only 18% more for free range eggs, and 12% more for organic eggs [Molnár, Szőllősi 2015], so they do not pay for the cost increase alternative systems imply. All this leads to the prediction that the proportion of free range or organic systems will – due to the lack of solvent demand – not grow significantly in Hungary in the future either, while local markets and different alternative sales channels provide opportunities for smaller producers using the deep-litter system to sell eggs at a higher price. More than 40% of all the eggs produced reach the consumers via direct sales channels [HCSO 2016], that is the role of short supply chains is significant in Hungary. Larger producers are subject to the low prices of the retail chains, so in general they cannot make use of the unit cost reduction due to size efficiency in their specific income.

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Streszczenie

Dokonano analizy wydajności ekonomicznej chowu w systemie klatkowym i systemie na głębokiej ściółce na fermach o różnej wielkości. Do analizy kosztów i przychodów wykorzystano dane pochodzące z Farm Accountancy Data Network (FADN) za lata 2004-2014, przekazane przez Węgierski Instytut Badawczy Ekonomiki Rolnictwa (AKI). Pomimo zmiany klatek przez hodowców, różnice w zakresie wydajności ekonomicznej chowu w obu systemach nadal się pogłębiały. Wykazano, że hodowcy stosujący system na głębokiej ściółce zwykle utrzymują mniejsze stada, a 36% stada jest utrzymywane w ramach działalności rodzinnej, gdzie wynagrodzenie nie jest rejestrowane jako koszty osobiste. Koszt jednostkowy i średnia cena sprzedaży jednego jaja zmniejszały się wraz ze wzrostem wielkości fermy, niezależnie od systemu chowu. Największy spadek średnich cen sprzedaży dotykał hodowców stosujących system klatkowy, utrzymujących ponad 25 tys. sztuk drobiu. W przypadku hodowców stosujących system na głębokiej ściółce spadek ten był odczuwalny już przy wielkości stada wynoszącej 10 tys. sztuk.

Correspondence address
Virág Szabó PhD (orcid.org/0000-0002-9439-8210)
HU-8144 Sárkeszi, Táncsics M. u. 5.
Phone: +36/202397596
e-mail: szabovirag03@gmail.com