https://doi.org/10.36007/3754.2020.57

DYNAMICS OF COMPETITION IN THE HUNGARIAN POULTRY INDUSTRY

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ABSTRACT

This study examines the competitive nature of the Hungarian poultry sector between 2006 and 2016. Throughout the period examined the poultry population stagnated, however the industrial sector changed structurally and the livestock in individual farms decreased. Our main goal to measure the market competition and specify the main drivers of the abnormal profit in the Hungarian poultry industry. Profit persistence was estimated using the Arellano-Bond GMM and Blundell-Bond dynamic panel. Based on our results, it can be said that the level of profit of the poultry sector is close to the equilibrium profit level. It can be stated that the the farm size and technological development as well as the tax advantages of sole proprietorship distort competition and result in higher profits. Taking long-term risk has a negative impact on abnormal profits. Based on the model, it can be said that the breakthrough point in the poultry sector is technological advancement and population growth, along with the suppression of labor.

KEYWORDS

profit persistence, competition, poultry sector, agriculture, dynamic panel

INTRODUCTION

Agricultural markets have undergone a significant transformation over the last 30-40 years and are very far from perfect competition. Due to corporate mergers and acquisitions, few agricultural players hold 60-80% of the market in each agricultural market and market concentration is significant in agriculture [1]. Horizontal integration affects few markets, but in addition to horizontal expansion, vertical integration is also typical in agriculture. In addition to vertical and horizontal concentration, the variety of products, the production of a given product in different qualities, and the variety all indicate that agricultural markets are not necessarily the best examples of perfect competition from a theoretical point of view. In my opinion, the foreign exchange markets are the closest to perfect competition, to give an example. The product is homogeneous, there are many players, information is immediately integrated into prices, but in the foreign exchange and financial markets there may also be players who are able to influence prices or these markets are also hit by crises.

Over the past 20 years the structure of the Hungarian poultry sector has been constantly changing, with a clear trend towards the decline of individual farms. There is agreement in the Hungarian literature that it is not possible to carry out the activity economically and profitably in case of a small farm size. The fragmentation of the competitive structure puts small businesses at a competitive disadvantage; therefore the current process can also be seen as a natural market purge. We present the trends of poultry flocks through the example of the most dominant species of poultry. Domestic hen stock was fluctuating during the period under

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review. Immediately after the accession to the EU the total domestic stock was close to 32 million individuals. Following the accession, similarly to the majority of animal husbandry sectors, the number of individuals decreased. In the new single market, the sector has recovered relatively quickly, with a ten percent increase in chicken stock between 2007 and 2011.

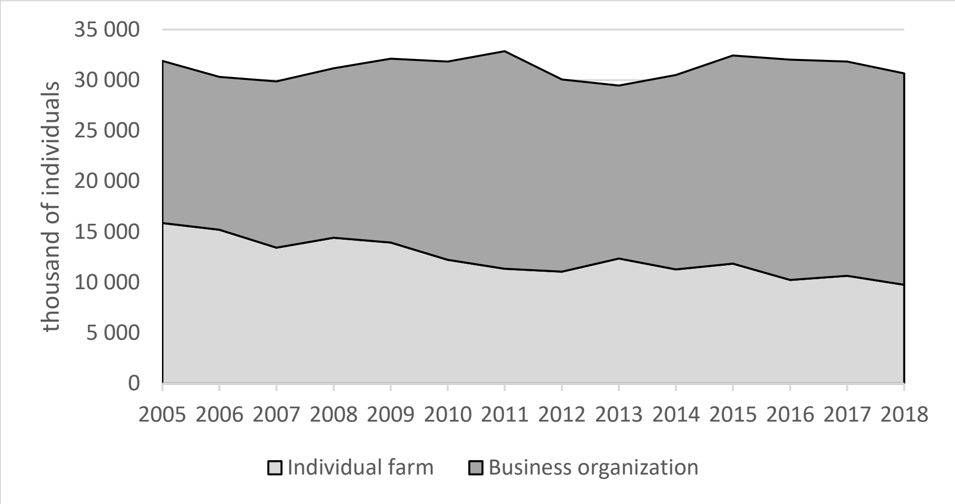

Figure 1: Development of the hen population in Hungary (2005-2018)
Source: Own editing based on KSH (Hungarian Central Statistical Office) [2] data

However, the whole sector was not affected by the expansion of production: the number of hens kept in individual farms continued to decrease during this period, and the increase in production was characteristic of the economic organizations. The reason for the difference lies primarily in the differences in the size of farms and the resulting operational conditions. The average size difference between individual and corporate farms is well illustrated by the data of the Research Institute of Agricultural Economics (hereinafter referred to as AKI - Agrárgazdasági Kutatóintézet) test farm system: based on the standard production value per farm, the average farm size of social poultry farms in 2005 was about eighteen times the average farm size of individual farms. The same rate reached 20 in 2011, and was already well over 40 in 2015 [3]. Popp [4] emphasizes that modern technologies cannot be used economically at small size, while natural efficiency will be low in case of outdated housing technology. Fragmented plant structure is identified as a competitiveness problem by Varga et al. [5], Nábrádi and Szőllősi [6], and Udovecz et al. [7].
On the basis of the above, it can be stated that after the initial downturn, a natural restructuring of the sector started in 2007, whereby the farms, which were typically larger in size, employing more modern technology and were more competitive, were able to expand their production. The growth process of the latter came to a halt in 2012. Rapid switching was largely caused by external factors. I will elaborate furhter on this below.
Another reason for the sector problems lies in regulatory changes. Market regulation burdens in the European Union have lead to significant competitive disadvantages vis-à-vis American and Asian competitors already in the early 2000s [8] [9]. In the second decade of the millennium, the administrative, animal welfare and environmental regulations concerning production and processing were further strengthened, for which even the poultry production units and slaughterhouses of the more developed EU member states were not fully prepared [5]. One of the striking examples of strengthening is the 2012 regulation on expanding and replacing laying hens' cages. Increasing the minimum seating capacity and obligatory perches not only increased production costs by 10-30 percent, but also increased the risk of injuries and deaths by increasing social stress and animal health risks [10].

LITERATURE REVIEW

The history of the measurement of profit persistence began with PCM models. Later, PCM method has been replaced by autoregressive models, primarily AR1. The next methodological development phase was to use the estimated AR1 parameter in an OLS model as a dependent variable and to use company-related and industry-related variables as independent variables. Roughly at the same time, fixed-effect (FE), pooled OLS, and in rare cases random effect (RE) models have been emerging. The primary use of panel OLS models was to estimate the AR1 parameter. After 2010 and nowadays, dynamic panel GMM models provide the most reliable estimate of profit persistence. GMM models usually deal with company-related, industry-related, and in some cases regional variables.

There are two similar studies, Hirsch and Gschwandtner [11] and Gschwandtner and Hirsch [12] on profit persistence, which we would like introduce here together. Both studies analyze the food industry in five European countries (Belgium, France, Germany, Italy and the United Kingdom) on data from 1996 to 2008. What makes the two studies different is the methodology chosen and the size of the sample. The study by Gschwandtner and Hirsch [12] includes 4,676 companies, while Hirsch and Gschwandtner [11] includes 5,494. In Gschwandter and Hirsch [12], short- and long-term profit persistence was estimated with AR1, and then the estimated coefficients were used as a dependent variable in an OLS model. Of the nine independent variables, five are company-related and four are industry-related indicators. Profit persistence and OLS models were estimated for each country separately. According the results, the Belgian food industry market is the most competitive (profit persitence value is 0.06), while the United Kingdom (0.23) is the least competitive, however, the significant profit persistence values are between 38-42% for all countries, so less than a half of the companies deviate from the normal profit level. In the OLS model estimating short-term profit persistence, company size and growth were significant in four of five countries. In the long-term profit persistence model, there are also significant corporate effects (market share, company age, company growth), a single industry variable (number of companies operating in the industry) has become significant in at least three countries.

In Hirsch and Gschwandtner [11] profit persistence was examined by dynamic panel GMM estimation. According tot he other study, Belgium had the lowest (0.11) and the United Kingdom had the highest (0.304) profitpersistence. In the GMM model, short- and long-term profit persistence cannot be calculated as easily as in the case of autoregressive models. The authors solved this by relating the parameters of the independent variables to long-term profit persistence, and to relate the interaction between the dependent variable and its time lag to short-term profit persistence. Compared to their previous study, some new variables were included in the research, such as short-term risk and market concentration. For at least 3 countries, the following variables are significant for short-term profit persistence: firm size and growth, short-term risk and industry concentration (CR5). Three of this four effects are company-related effects, the result is very similar to the OLS estimation. Under the same criteria, short-term and long-term risk for long-term profit persistence is significant in at least three cases. Based on the results, high profit persistence is characteristic of young and large companies with a low risk rating. Another conclusion is that the food industry has lower profit persistence. In his doctoral dissertation, Hirsch [13] reported only the results of the GMM estimation. In his meta-regression study, Hirsch [14] highlights that many profit persistence research contains bias (cites some of his own studies as examples) because micro-sized firms are under-represented in the samples, which may result in profit persistence being overestimated. In the case of the two studies presented, a similar problem arises, so the real profit persistence values may be even lower.

The study by Tamirat et al. [15] is most similar to our empirical research. The authors used the Dutch FADN database, the data are from 2001 to 2015 and contain a total of 1796 companies.

From the FADN database, dairy farms, field crop production, pig keepers and the category of livestock (cattle, poultry, pig and lamb mixed) were highlighted, with the largest number of pig keepers. To test the robustness of the results, two types of profit indicators (modified ROA and net profit margin) were also calculated. Three methodologies are used in the study, OLS, quantile OLS, and GMM. For the OLS and quantile OLS estimates, the authors do not incorporate the lagged profit rate into the model, so I present only the results of the GMM models, focusing on the whole sample and the pig keepers. GMM models were filtered by year, region, and land type effect. Considering the modified ROA, the profit persistence is 0.075 for the total sample, and 0.071 for the pig keepers. These are also very low values compared to the food industry (0.11-0.34). For both estimates (complete sample; pig keepers), long-term risk, firm age, size, and labor productivity were significant. In addition, working capital, capital intensity, and diversification are also significant variables in the overall sample. Considering the net profit margin, very similar results were obtained. Interestingly, the subsidy rate is not significant in either case, only for dairy farms. The only flaw in the models is that the unit of working capital is 1,000 euros, while all the others have some ratio or logarithm, so the differences in size do not disappear completely, despite the authors controlling the size.
Gschwandtner and Hirsch [16] compared the profitability of the food processing industry in the European Union and the United States. Profit persistence analysis was performed with dynamic panel and GMM estimation, the comparability of samples was ensured by matching. In addition to the GMM estimation, the authors also performed the classical OLS estimation, with the aim of demonstrating the robustness of the estimation and quantifying the error of the OLS estimation (compared to GMM). The value of profit persistence became around 0.3 in both samples (GMM estimation), there is no significant difference between the EU and the US. This also means that profit persistence egsists on both continents. The authors mention that a profit persistence of 0.3 is lower than for other manufacturing industries. This finding was also made by Hirsch and Gschwandtner [11], Hirsch and Hartmann [17] and Goddard et al. [18], among others, in their previous study. Among the company-related variables, the size of the company (logarithm of all assets), short-term risk (current liabilities / current assets) and long-term risk (long-term liabilities / equity) became significant. The size of the company and long-term risk show a positive relationship with the profit level, while short-term risk shows a negative relationship. Among the industry variables, a negative significant relationship was found for industry growth (industry revenue growth). In the EU sample, the coefficient is positive for the Herfindahl index. The authors tested the impact of the crisis in two ways: on the one hand, they marked the years of the crisis with dummy variables (the results of which were not reported), and on the other hand, rerun the estimate, excluding the years 2008 and 2009. In the case of the first method the crisis dummy variable did not become significant, in the case of the second method the profit persistence increased, however, the difference was not significant compared to the whole sample.
Figure 2 summarizes the significant variables found in the relevant profit persistence studies in the food industry. We can see that company-related impacts are the most relevant.

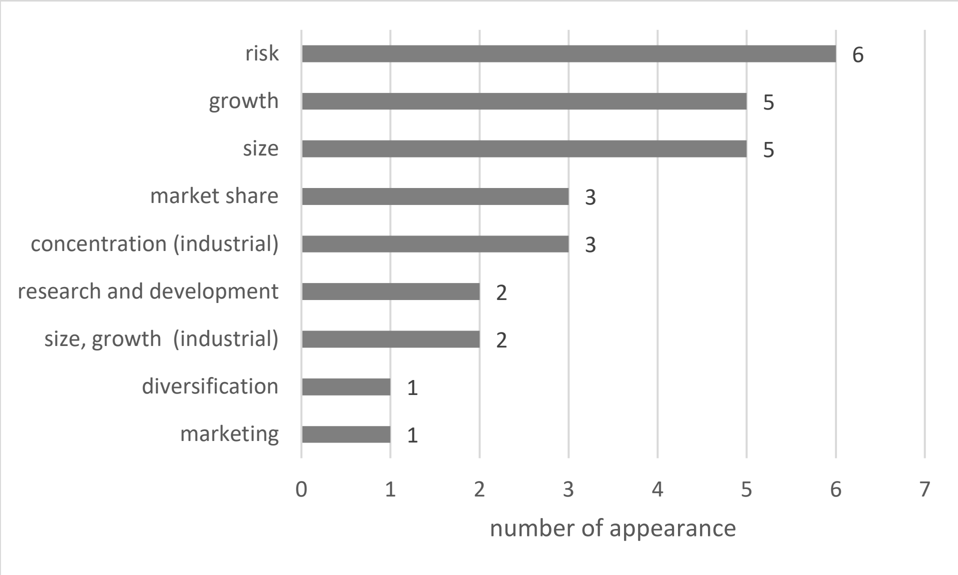

Figure:2: Proxy of significant variables from the related literature
Source: own editing based on related literature

DATA AND METHODOLOGY

During the research I used data from the National Agricultural Research and Innovation Centre (NAIK) Research Institute of Agricultural Economics (AKI) test Farm Accountancy Data Network (FADN). Every country in the European Union has the FADN system, which collects data about more than 80,000 farms. The EU-wide database represents a population of approximately 6.4 million [19]. The database is representative of region, size and activity. Due to the form of data provision the data of individual and corporate farms becomes comparable. The Hungarian test farm system covers 2% of the population; the monitored plants provide more than 5000 data a year. Our sample contain 180 poultry farms.

During the abnormal profit test, I analyze the extent to which each firm's ROA for a given year differs from its average annual profitability level. Thanks to normalization, we can filter out the effects of macroeconomic cycles and interpret profit as a deviation from market norms [20] [21].

$$\pi'_{i,t} = \frac{ROA_{i,t} - \overline{ROA_t}}{\overline{ROA_t}} \quad (1)$$

$\pi'_{i,t}$ denotes abnormal yield.

Initially, autoregressive processes were used to measure profit persistence, most often the AR (1) model. In number of lag 1 model, the profit rate at time t is explained by the profit rate one year earlier (t-1). In addition to autoregressive models, OLS models have appeared, most often using persistence values from AR (1) models as dependent variables. Today, the most reliable estimate is made by dynamic panel models.

Hirsch and Gschwandtner [11] found that due to the previously presented limitations of AR model estimation, the dynamic panel model with the Arellano-Bond Generalized Method of Moments (GMM) estimation is the most suitable for investigating profit persistence. According to Hirsch [14], GMM is the proper technique for estimating profit persistence, OLS estimation biases upwards. The estimation can be applied well if there is a large number of observed companies (small T, large N type sample) for a short period of time.

$$\pi'_{i,t} = \sum_j \alpha_j (X_{j,i,t}) + \lambda \pi'_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Where $\varepsilon_{i,t} = \eta_i + \nu_{i,t}$. The Arellano-Bond GMM estimate is based on the first differences in the equation, which eliminates time-invariant firm specific (η_i) effects [11] [22]. Firm and industry-specific variables (X_j) that may explain the persistence of corporate profits may be included in the model. The GMM estimate is considered consistent if there is no second order autocorrelation in the error terms (the first order cannot be due to the delayed explanatory variable) and the instruments are adequate. Second-order autocorrelation is easy to test, and instruments can be tested by Hansen and Sargan test. The lagged depended variable is endogenous; everything else is exogenous variables in the model [11]. The Hansen test is robust to heteroscedasticity.

The upper and lower few percentages of the distribution of variables were handled with trimming due to the outliers. The database certainly contains human error, it takes several steps to populate the database with data, and problems may arise during queries. For this reason, a "cut off" of few percents of the data is justified. The treatment was performed for all variables. During the literature review, it happened only a few times that a different dynamic panel estimation procedure appeared in addition to the GMM model. In order to test the robustness of the results, I also performed a profit persistence estimation using the Blundell-Bond (1998) method. The Arellano-Bond GMM estimation procedure gives more reliable results than the panel OLS estimates, but does not perform perfectly. The Arellano-Bond GMM performs very poorly if the auto-regressive parameter (λ) is too large or the ratio of the variance of the panel effect and the variance of the individual error terms is too large [23], the Blundell-Bond model was developed to remedy this.

The Blundell-Bond estimate assumes that there is no autocorrelation among the individual error terms, and that proper operation requires that the panel effect be independent of the first difference in the first observation of the dependent variable. Just like the Arellano-Bond estimate, Blundell-Bond works well when we have a lot of observations, but the time parameter is finite. For profit persistence estimates, the Arellano-Bond method can be considered to be the standard, in my opinion the reason for this is that the Blundell-Bond estimate gives a more reliable estimate when the autoregressive parameter is high, but profitable persistence is typically low in agriculture and food industry. For this reason, I consider the results of the Arellano-Bond estimate to be the guideline, and I use the Blundell-Bond estimate to check the robustness of the results.

The Markov chain analysis was based on the study of Stephan and Tsapin [24], through which I formally present the method. Denote the rate of profit by y_s^t, the Markov chain working with discrete values requires the following relationship:

$$P\{y_s^{t+1} = j | y_s^t = i\} = p_{ij} \quad (3)$$

It can be read from formula (3) that the profit rate in t+1 depends only on the state at time t. The transition between each group can be described as follows:

$$F_y^{t+1} = P * F_y^t \quad (4)$$

F_y denotes the distribution of corporate profitability in t and t +1. These equations can be used to estimate the transition probability matrix. The estimated probabilities will be unbiased if two conditions are met: 1) the data generating process (companies 'profit rate) is constant over time, so its variance is constant; 2) the number of observations is sufficiently large.

RESULTS

One of the main drivers of the restructuring of the poultry sector is economies of scale. Szőllősi and Nábrádi [25] found that one of the problems identified in the study of poultry sector problems was lower than optimal size, Szőllősi and Molnár [26] found similar consistency in relation to profitability and size. Sipiczki et al. [27] found that the average farm size was the lowest in the pig and poultry sector. Accordingly, farm size was expected to have a positive impact on the profitability of poultry farms. In my study, I use two variables to express the size of the farm: the number of poultry kept by the farm (number of animals) and the balance sheet total. The former serves to express the natural size of the farm, while the latter serves to express the size of the farm. The relationship between profit persistence and company size (balance sheet total) is unclear. In the case of large size, the principle of economies of scale may work, although several studies have been written about less efficient large companies. Company size plays a significant role in the food industry [11] [17]. We expect a positive relationship between size and (abnormal) profitability in the Hungarian agricultural environment.

Another important factor is the mechanization of farms. To overcome the gap with advanced European competitors, the use of modern housing technology is required. Thanks to technological investments, natural efficiency indicators and thus profitability are significantly improved. One of the biggest problems of the poultry sector is the lack of technological development and innovation [6] [28] [29] [30]. In domestic literature, technology is a recurring problem. Similar sentences can be found: "our professional knowledge is stagnant at the leel of 1995-2000; our management knowledge is at the level of 15-20 years before" (Nábrádi & Szőllősi [6] cited by Bárány [31]). According to the literature, the poultry sector is facing a major technology gap and there has been no significant progress at the sector level in the last 20 years. As a result, the poultry sector model includes two variables expressing the mechanization of the holdings.

In the lack of investment and innovation, technology is the substitute for labor, which, with a few exceptions, is less effective than its machines. To express technological development, one (two in the case of poultry) mechanization index and one in the labor utilization index were included in the model. According to preliminary expectations, mechanization has a positive effect, while the latter has a negative impact on profitability.

Jankovics [30] states that cereal prices and broiler feed prices move closely together, but the real problem is that rising cereal prices increase costs more than that of chickens for slaughter. The biggest problem in the profitability of table egg producers besides size is the volatility of feed prices [26]. According to Szőllősi's [32] calculations, 60% of the costs of broiler chicken fattening is determined by the purchased feed. On this basis, profitability is very sensitive to changes in prices. The unfavorable development (opening) of the price scissors of industrial-agricultural products has a significant impact on the profitability of agricultural farms [33]. Varga et al. [34] found that price scissors have shown a favorable image in agriculture over the past 10 years, but the picture is improved by crop production and the situation for livestock farmers remains unfavorable. Taking all this into account, we can assume that the proportion of purchased feed within the total feed cost has a negative impact on profitability.

To realize positive returns, you need to take the risk, and risk is included in the definition of a business. According to profit persistence research, I approach the concept of risk from an accounting point of view, accordingly short-term and long-term risk depending on the time horizon of indebtedness. High risk is expected to result in high expected returns (see CAPM model). Bowman [35] found a negative correlation between risk and profit, which is supported by the practice of smoothing profits. Profit persistence research in the food industry has found a positive and negative relationship between risk and profitability. In most cases, long-term risk is positive or insignificant, and short-term risk has a negative impact on food companies. In his study, Borszéki [36] determined the cost of capital for the pig and poultry sectors, based on calculations, the optimal leverage ratio for each of the two sectors is 35%, ie approximately two thirds of the liabilities side is equity and the remaining debt. This is far below the real capital structure, one of the main reasons of which is the lack of own resources needed for foreign sources [33]. The lack of technological development is rooted in the same place. This discrepancy / diversity characterizes well the relationship between risk and profitability, and consequently, we have no clear expectation of the relationship between any of the risk indicators.

The European Union and the prevailing domestic government policy have a special focus on agriculture. The level of subsidies in agriculture is outstanding compared to other industries [37] [38], and it is worth highlighting the favourable financing arrangements that are not effectively used by the farms. Subsidies received under the Common Agricultural Policy (CAP) also had a significant impact on the profitability of agricultural economies and the structure of production [39] [40]. These factors mean a reduction in operational risks, so we use the subsidy ratio of total output as a control variable. Interestingly, except in one case, empirical studies in international literature do not include any form of support. The only exception is Tamirat et al. [15], where the proportion of subsidies is not explanatory in Dutch agriculture as a whole; the same is true for field crop production and pig holdings (!). There was a positive relationship in dairy farms and a negative (!) relationship in mixed livestock holdings between aid intensity and profitability. In my opinion, it is difficult to deny the subsidy dependence of the Hungarian agricultural economy although it is important to consider that the subsidy rate is much lower for livestock farmers than for crop producers. Moreover, according to Sipiczki et al. [27], poultry and pig holdings are the most profitable sector within agriculture, but, if subsidies are taken into account, they become the least profitable. Several studies confirm that the profitability of poultry holdings has deteriorated with the reduction of subsidies [25] [28]. With these in mind, I expect the relationship to be positive or neutral.

In case of changing the form of the enterprise, I assume that the profitability of non-business enterprises (typically primary producers, sole proprietors) is higher. The reason for this is that the primary farmers' tax rules provide significant benefits and exemptions for families operating the farm. The poultry sector is definitely characterized by a very small, sub-optimal [25] farm size, which gives tax advantages. As a result, I expect the variable to have a negative sign (I mark companies with 1).

Table 1: Expected impact and descriptive statistics of the variables used in the research

variables	Expected impact	Mean	Median	Std. dev.
abnormal ROA.L1	0/low	0,096	-0,229	6,333
ln total assets	+	10,492	10,496	1,294
subsidy ratio	+/0	0,043	0,037	0,037
ln labor	-	0,713	0,647	0,820
purchased feed	-	4,064	3,283	2,920
ln number of poultry	+	8,848	8,985	1,412
long risk	+/-	0,444	0,000	1,288
short risk	+/-	5,577	1,634	14,435
mechanization _assets	+	0,048	0,008	0,087
mechanization_number	+	0,276	0,031	0,674
form of business	-	0,346	0,000	0,476

Source: own editing

Table 2 shows the transition probabilities for the poultry sector. While the ROA and aROA matrices are very similar for the pig sector, the aROA probabilities are lower in the poultry sector in most cases. So high ROA values do not automatically mean that abnormal profits are also high. The industry average profitability and the profitability of individual plants are more likely to move together. The values in the diagonal are low. Values above 0.5 indicate strong profit persistence [41]. Based on the values the competition is expected to be close to perfect competition.

The dynamic panel estimation will give a more accurate picture because 1) the conditions of the model are less strict (time invariance) than in the case of the Markov chain and 2) it is possible to control for different effects to get the most accurate value for the profit persistence coefficient. The Markov chain is appropriate as a starting point, and based on the results obtained, I have some expectations about the dynamics of competition in the two sectors.

Table 2: Transition Probability Matrices

ROA	(1)	(2)	(3)	(4)	(5)	P_i
(1)	**0,413**	0,215	0,162	0,093	0,117	0,200
(2)	0,226	**0,341**	0,204	0,137	0,093	0,200
(3)	0,137	0,224	**0,282**	0,232	0,125	0,200
(4)	0,103	0,120	0,265	**0,322**	0,190	0,200
(5)	0,070	0,104	0,104	0,235	**0,487**	0,200
P_j	0,191	0,200	0,204	0,204	0,201	1,000
aROA	(1)	(2)	(3)	(4)	(5)	P_i

(1)	**0,332**	0,199	0,170	0,129	0,170	0,200
(2)	0,155	**0,400**	0,241	0,141	0,064	0,200
(3)	0,118	0,192	**0,314**	0,269	0,106	0,200
(4)	0,104	0,121	0,264	**0,281**	0,229	0,200
(5)	0,180	0,160	0,121	0,199	**0,340**	0,200
P_j	0,179	0,214	0,225	0,205	0,179	1,000

Source: own editing based on STATA output

The results of the Arellano-Bond dynamic panel estimation are shown in Table 3, Blundell-Bond results are in Table 4. Hansen and Sargan test results are satisfactory. The profit persistence value is 0.108, but not significant, in fact zero. On the one hand, surprisingly rare is the study in which profit persistence is zero (eg Kozlenko [22] for some food sectors). On the other hand, on the basis of Hungarian literature, it has been emphasized on several occasions that the poultry farms are small, which is one of the barriers to profitability [25] [27].

Table 3: Results of dynamic panel estimation (Arellano-Bond)

Arellano-Bond	Coefficient	Corrected Std. error	p-value
abnormal ROA.L1	0,108	0,109	0,325
ln total assets	-0,309	0,235	0,189
subsidy ratio	3,669	4,215	0,385
ln labor	-0,088	0,198	0,659
purchased feed	-0,022	0,064	0,737
ln number of poultry	0,478	0,277	0,087*
long risk	-0,424	0,136	0,002***
short risk	0,000	0,007	0,966
mechanization _assets	-6,475	3,190	0,044**
mechanization_number	0,574	0,323	0,077*
form of business	-0,822	0,436	0,061**
Tests			
AR(2)	z = -0,61		0,544
Sargan	Chi2(31) = 33,68		0,339
Hansen	Chi2(31) = 35,80		0,253

Source: own editing

***, **, *Significant, on 1, 5, 10%

Table 4: Results of dynamic panel estimation (Blundell-Bond)

Blundell-Bond	Coefficient	WC-Robost standard error	p-value
abnormal ROA.L1	0,001	0,021	0,955
ln total assets	-0,580	0,303	0,055**
subsidy ratio	1,705	7,673	0,824
ln labor	0,263	0,376	0,484
purchased feed	0,002	0,095	0,986
ln number of poultry	0,856	0,325	0,008***
long risk	-0,580	0,093	0,000***
short risk	0,002	0,013	0,882
mechanization _assets	-2,729	3,785	0,471
mechanization_number	1,101	0,436	0,012**
form of business	-1,860	0,947	0,049**
Test			
AR(2)	z = -0,89		0,375

Source: own editing
***, **, *Significant, on 1, 5, 10%

In the case of farm size, the natural indicator is significant, so by increasing the average number of poultry per year the profitability of the companies also increases, the result explains the principle of economies of scale. There are examples in the international literature where the increase in size (from an accounting point of view) reduces profitability, but in the case of the Hungarian poultry sector this "critical size" seems to be far away. The results confirm the domestic theoretical and empirical researches in the poultry sector.

In addition to the indicator ($\frac{stable\ livestock\ machinery}{all\ equipment}$) used in the sector to measure mechanization, the machinery per poultry (mechanization_number) was examined. The reason for the inclusion of the two variables was to get a more accurate picture of the depressing technological situation according to the literature. All are significant, but with a different sign. In my opinion, the natural approach gives a more accurate picture, so with the growth of stable machinery per bird, efficiency increases and thus profitability. According to Szőllősi and Szűcs [29], it is the only way to improve the profitability of the poultry sector; Jankovics [30] also comes to a similar conclusion to escape forward. The variable for labor has no explanatory power. In the case of mechanization relative to the balance sheet total, accounting adjustments (the difference between real and calculated depreciation) and other items increasing or decreasing the balance sheet "move" this indicator. Although the logarithm of the balance sheet total is not significant, studies have treated declining plant size as a fact, so this effect also influences the mechanization index affected. A further reason for the negative impact is that investments are leveraged, as measured by long-term risk.

Long-term risk has a negative impact on profitability. This is another sign of inefficiency and size problems. Improvements can be made primarily through the involvement of external capital, but with own funds, a farm is not indebted if the future expected profits yield the interest of the loan. In the current situation of the Hungarian poultry sector, this is a trap. In addition to low profitability, indebtedness in the short term is bound to worsen profitability, which owners are unlikely to undertake. Without improvements, profitability will also deteriorate, but in this case, it will be a slow process lasting several years, even decades, while in addition to indebtedness, there may be a sharp downturn and future returns are not guaranteed. In such a situation, it is difficult to choose the riskier way; especially if we consider the words of Bárány

[31] that management knowledge is 15-20 years behind. The short-term risk is not significant according to the model. It is worth mentioning here the study of Borszéki [36], who argues that the increase in trade payables does not mean an improvement in the market financing position, but rather the presence of the chains of debts, which is a sector problem.

Calling for grants and their rational use for development and risk reduction may be an appropriate "means". According to the model, the increase in the subsidy ratio within total output does not affect profitability. The reason for this is the low level of support compared to other agricultural sectors. The study of Sipiczki et al. [27] is telling, according to which, without subsidies, the poultry sector is one of the most profitable agricultural sectors, taking into account the subsidies, the other sectors are improving to the extent that it becomes the least profitable. Several studies highlight the under-support of the poultry sector / egg production [25] [26] [33]. For these reasons, the neutrality of the subsidies is not surprising.

Purchased feeds variable is negative but not significant. In the model specification section, several authors mention the opening of the price scissors of industrial-agricultural products. Calculations have shown that the input price increase is higher than the output price increase, which clearly has a negative impact on profitability. The poultry sector has a high proportion of purchased feeds, as it is confirmed in Popp et al. [42], according to which 50% of the nutrient mixes produced in Hungary in 2016 was poultry feeds, half of the feed mills produce poultry feeds. From this, two conclusions can be drawn: It is likely that poultry feed production is a profitable activity and, on the other hand, poultry farms are not thinking about producing their own feed but buying. According to preliminary expectations, business companies will achieve lower abnormal profits and individual farms will be able to claim tax benefits.

DISCUSSIONS

The poultry sector has undergone a major transformation over the last two decades, and, according to a clear trend, most small-scale farms are unable to compete in the EU single market. I measured market competition with abnormal profit (part above industry profit) persistence. The profit persistence of the poultry sector is not significant, from a theoretical point of view it is close to perfect competition. Many small, sub-optimal plants justify the profit persistence value obtained.

In the case of the dynamic panel model it can be stated that increasing the number of poultry (pcs) improves profitability and reduces competition, but the rate of aid does not affect the abnormal profit and thus has no distorting effect on the sector. Efficiency technology investments will improve the abnormal profitability of farms, which is a breakout point for the poultry sector. Labour (head) and purchased feed have no demonstrable effect on above-market yield. Among the risks, long-term indebtedness reduces abnormal profits, if the debt is invested in proper mechanization, companies can gain a competitive advantage in the long run. Individual farms have the potential to achieve higher returns in relative terms.

The results of the research, in comparison with the literature (theoretical and empirical), confirm the fact that the improvement of the international competitiveness of the sector within the Hungarian dual plant structure is clearly conceivable with large-scale, low-unit labor-intensive economies. Consequently, policy strategies and measures to maintain or possibly increase the Hungarian poultry population should be designed with this in mind, primarily focusing on the development of medium and large-scale livestock production.

The development of the competitiveness of individual and family farms can only be successful if future development programs and subsidies support the achievement of at least a medium-sized farm, the reduction of specific labor utilization, horizontal and vertical integration, and the provision of their own fodder base. An additional breakthrough point may be the expansion of one's own slaughtering and processing capacities, but the dissertation does not aim to support this statement.

ACKNOWLEDGMENTS

SUPPORTED BY THE ÚNKP-19-3-KE-23 NEW NATIONAL EXCELLENCE PROGRAM OF THE MINISTRY FOR INNOVATION AND TECHNOLOGY.

The research was supported by EFOP-3.6.2-16-2017-00018 in Kaposvár University project.

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