

## **RELATIONSHIP OF PRODUCTIVITY AND PROFITABILITY OF BROILER CHICKEN PRODUCTION TO INCIDENCE OF AVIAN INFLUENZA IN WILD BIRDS IN POLAND**

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### **Abstract**

**Production and economic results were analysed for six production cycles of three broiler chicken farms in the years 2005–2006. Three of these cycles coincided with the initial period during which avian influenza spread among birds in Europe, and the remaining three cycles coincided with the actual incidence of the disease in European countries, including Poland. The decreasing demand for poultry meat in Poland in early 2006 led to a decline in the procurement prices for live broilers. Due to a difficult market situation, producers strived to lower their own production costs and labour costs were found to decrease. In spite of the good production results obtained, profitability of live broiler production decreased in early 2006 when avian influenza cases were identified in wild birds in Poland. This was reflected in the agricultural income declining 6–86% in the 2006 cycles compared to the 2005 cycles.**

**Key words: broiler chickens, profitability of production, net income**

Broiler chickens are one of the important sectors of poultry production in Poland. Its success and chances for further development are largely determined by the profitability of farms. A notable improvement of broiler rearing performance was noted in the second half of the 20th century. It was possible mainly due to genetic selection of birds for rapid growth rate (Havenstein et al., 1994, 2003; Renema et al., 2007). The short period of broiler chicken rearing, currently lasting less than six weeks, enables an average of six production cycles to be completed per year. This makes it possible to analyse the effect of short-term changes in market mechanisms (such as sales and demand) on the economic effectiveness of broiler farms.

The analysis presented in the paper was inspired by a decline in demand for poultry products, including broiler chicken meat, observed at the turn of 2005/2006 both

in the world and in Poland. It seemed interesting to determine whether lower interest in poultry products had any influence on the operation of farms specializing in broiler chicken rearing.

Avian influenza is a disease found in domestic poultry and wild birds. It is caused by type A influenza virus (Ellis et al., 2004). The type A influenza viruses belong to a group of zoonotic agents and are able to cross the interspecies barrier between animals and humans (Wong et al., 2006). A rapid increase in the number of avian influenza cases in poultry was noted in 2004 and increasingly more human cases of bird flu were registered especially in the Far East. In the first months of 2006 avian influenza virus was detected in wild birds on the territory of Poland. This led to the outbreak of so called "media flu", which added to anxiety among consumers and caused a decrease in demand for poultry meat (Jutzi and Domenech, 2007).

The aim of the paper was to determine the effect of incidence of avian influenza in wild birds in Poland on productivity and profitability of selected broiler chicken farms.

### Material and methods

The economic results of production cycles at three commercial farms rearing broiler chickens in the years 2005–2006 were analysed. The data were collected using a questionnaire for assessment of broiler production effectiveness.

The farms were marked with the letters A, B and C. All of them practised an intensive production system comprising six rearing cycles per year. The owners of farms A and B signed long-term delivery contracts with Poultry Meat Processing Plants. On the other hand, the owner of farm C was selling his poultry for slaughter to several slaughterhouses. Farm A operates as an agricultural production cooperative, where broiler chicken rearing is one of the branches of production. Production is run in a complex of 12 buildings with an area of 1000 m<sup>2</sup> each. Farms B and C are private commercial farms operating as family enterprises. On farm B broiler chickens are kept in one building with an area of 2000 m<sup>2</sup>. On farm C the birds are housed in two broiler houses with areas of 1500 m<sup>2</sup> and 600 m<sup>2</sup>, respectively. In all the buildings of all three farms, feed and water is distributed automatically using Flex-Augur system and nipple drinkers. Standard light regime and diet were used. The feed came from a feed mill. Farms A and B have the same feed supplier. During the period of observation all farms were rearing the same Ross 308 commercial hybrids.

Data on production and economic results comprised six broiler rearing cycles. Three of them coincided with the initial period of flu epidemic among birds in Europe, i.e. the months from August to December 2005. The other period covered the months from January to May 2006, when the disease was found in wild and domestic birds in the European countries.

Accounting documents kept on farms provided data on the initial number of broiler chickens used for rearing, mean length of the rearing period and average body weight of bird. Population density per m<sup>2</sup> of the building production area was computed, and mortality (%), broiler chicken production per m<sup>2</sup> of the production area, feed con-

version rate per kg of weight gain and European Production Index (EPI) were also determined.

Total costs of production were divided into direct and indirect costs according to the type of operation and place of origin (Skarzyńska, 2007). The costs were converted into 1000 kg of birds for slaughter in order to be comparable. The direct costs comprised the costs of basic agricultural inputs. The indirect costs included the costs which are independent of the scale of production and are fixed costs. The gross (net) income was computed as the absolute measure of agricultural production profitability.

## Results

The results of broiler chicken production obtained on farms A, B and C are presented in Table 1. Stocking density per m<sup>2</sup> of the building production area ranged from 16 to 22 birds. The lowest mortality rate was recorded on farm B, where it reached 4.2% of the initial flock on average. On the other farms this parameter exceeded 5%. The average length of broiler rearing period ranged from 42 to 46 days. After this period of fattening, broilers on farm B achieved the highest mean body weight of 2.5 kg with feed conversion rate of 1.9 kg per kg of weight gain. Mean values of EPI were the highest on farm B (298.2), being 39.6 points higher than those computed for farm C and 56.9 points higher in comparison with farm A.

Slight differences in chicken rearing results between the farms were noted for the 2005 and 2006 cycles. On farm A and B they mainly concerned bird mortality and stocking density. The EPI value calculated for farm B in 2005 was an average of 12.5 points higher than in 2006. On farm C, broiler chicken production decreased in the second and third cycles of 2005 because one building was not filled with the birds.

Real costs of broiler chicken production per 1000 kg of slaughter weight on the analysed farms A, B and C are shown in Tables 2, 3 and 4, respectively.

Direct costs ranging from 95.5% (farm A) to 97.7% (farm C) prevailed in the percentage structure of unit costs generated by the farms. The highest costs of chicken rearing were recorded on farm A (an average of 627.71 Euros in 2005 and 647.82 Euros in 2006 per 1000 kg of live weight).

An increase in heating costs was noted on all three farms in 2005 compared to 2006. In the second year analysed, their average proportion in the cost structure increased from 4.3% to 6.8% on farm A, from 2.9% to 4.4% on farm B, and from 3.4% to 5.8% on farm C. In the second year of the study a decrease in hired labour costs was noted.

Profitability of production expressed by the net income per 1000 kg of live weight is presented in Table 5. On each of the analysed farms the net income was the highest in the first production cycle of 2005. In the second year of the study, mean values of the net income were lower on each farm analysed. The income decreased by 6.3% on farm A and by 7.9% on farm B, with the highest decrease of 86.6% being found on farm C. On farm C, production proved unprofitable in the first and second production cycle of 2006 (net income assumed negative values). In all three cases, production profitability began to improve as late as the third cycle of 2006, but it remained much lower than at the beginning of 2005, i.e. before avian influenza cases in wild birds in Poland were reported in the media.

Table 1. Production results of reared broiler chickens obtained on farms A, B and C in selected cycles of 2005 and 2006

Item	Year 2005						Year 2006		
	Productive cycle			$\bar{x}$	Productive cycle			$\bar{x}$	
	1	2	3		1	2	3		
	<b>Farm A</b>								
Number of housed birds	193 009	201 600	214 800	203 136	202 800	220 000	242 400	221 733	
Stocking density (head/m <sup>2</sup> )	16.1	16.8	17.9	16.9	16.9	18.3	20.2	18.5	
Stocking density (kg/m <sup>2</sup> )	34.9	38.2	37.6	36.8	37.2	39.7	46.9	41.2	
Mortality and culls (%)	5.4	8.6	5.0	6.3	5.1	5.2	5.5	5.3	
Mean length of rearing period (days)	43.0	42.5	44.0	43.2	43.5	44.0	45.0	44.2	
Mean body weight (kg)	2.17	2.27	2.10	2.18	2.20	2.17	2.32	2.23	
Feed conversion rate per kg of body weight (kg)	1.95	2.06	2.02	2.01	2.04	2.01	2.03	2.03	
European Production Index (EPI)	244.8	238.1	224.4	235.8	235.3	232.6	240.0	236.0	
	<b>Farm B</b>								
Number of housed birds	38 150	42 600	44 100	41 617	43 004	42 000	39 164	41 389	
Stocking density (head/m <sup>2</sup> )	19.0	21.3	22.0	20.8	21.5	21.0	20.0	20.8	
Stocking density (kg/m <sup>2</sup> )	46.4	56.4	59.4	54.1	53.1	51.5	46.2	50.2	
Mortality and culls (%)	6.5	3.7	6.4	5.5	2.5	4.1	2.1	2.9	
Mean length of rearing period (days)	42.5	44.0	44.0	43.5	43.5	43.0	42.0	42.8	
Mean body weight (kg)	2.44	2.65	2.70	2.60	2.47	2.45	2.31	2.41	
Feed conversion rate per kg of body weight (kg)	1.94	1.84	1.88	1.89	1.77	1.95	2.02	1.91	
European Production Index (EPI)	276.7	315.2	305.5	299.1	312.8	280.2	266.5	286.5	
	<b>Farm C</b>								
Number of housed birds	36 300	35 300	36 100	35 900	24 450	10 500	33 630	22 860	
Stocking density (head/m <sup>2</sup> )	17.3	16.8	17.2	17.1	16.3	17.5	16.0	16.6	
Stocking density (kg/m <sup>2</sup> )	39.3	35.6	40.4	38.4	35.9	40.2	34.7	36.9	
Mortality and culls (%)	5.8	6.4	5.3	5.8	5.2	4.8	5.5	5.2	
Mean length of rearing period (days)	44.5	42.0	45.0	43.8	46.0	44.0	43.0	44.3	
Mean body weight (kg)	2.27	2.12	2.35	2.25	2.20	2.30	2.17	2.22	
Feed conversion rate per kg of body weight (kg)	1.87	1.80	1.85	1.84	1.90	1.90	1.84	1.88	
European Production Index (EPI)	257.0	262.5	267.3	262.3	243.9	261.9	259.2	255.0	

Source: Own researches based on empirical data obtained from farms.

Table 2. Real costs (EUR) of broiler chicken production on farm A in selected cycles of 2005 and 2006 (per 1000 kg of livestock)

Item	Year 2005				Year 2006			
	productive cycle			$\bar{x}$	productive cycle			$\bar{x}$
	1	2	3		1	2	3	
	Per 1000 kg of livestock (gross)							
Direct cost	592.79	605.09	618.76	599.53	651.69	638.09	567.84	619.20
Cost of feed	392.77	404.37	381.48	392.87	392.71	381.57	385.52	386.60
Cost of chicks	121.06	125.79	130.81	125.89	129.08	143.48	122.92	131.83
Sanitary and veterinary costs	9.74	10.36	8.77	9.62	9.21	9.78	4.59	7.85
Electric energy	13.94	11.98	11.18	12.38	15.55	14.09	10.75	13.48
Costs of heating	14.74	19.54	48.79	27.69	70.66	51.13	14.01	45.28
Loading of broilers	6.59	6.51	8.03	6.96	6.88	7.26	5.57	6.57
Casual, lease labour	18.69	17.35	17.30	17.77	16.07	15.53	13.86	15.14
Social insurance	3.98	2.83	4.10	3.63	3.64	3.57	2.85	3.36
Other materials	10.19	4.85	6.91	7.31	7.24	10.68	5.90	7.93
Other costs	1.09	1.52	1.39	1.34	0.67	0.98	1.85	1.16
Real indirect costs	34.50	37.93	40.84	28.16	37.73	30.01	30.18	32.67
Fuel	1.39	1.14	1.39	1.32	1.54	1.39	1.26	1.39
Costs of credit	4.80	7.33	7.33	6.49	6.39	4.03	5.54	5.31
Depreciation	14.99	14.22	13.87	14.37	14.50	13.55	11.55	13.19
Faculty costs	13.32	15.24	18.24	15.66	15.40	11.04	11.83	12.76
Total costs	627.29	643.02	659.60	627.71	689.68	668.12	598.02	647.82

Source: Own researches based on empirical data obtained from farms.

Table 3. Real costs (EUR) of broiler chicken production on farm B in selected cycles of 2005 and 2006 (per 1000 kg of livestock)

Item	Year 2005				Year 2006			
	productive cycle			$\bar{x}$	productive cycle			$\bar{x}$
	1	2	3		1	2	3	
	Per 1000 kg of livestock (gross)							
Direct cost	541.02	473.47	491.02	501.80	494.48	527.64	535.34	519.15
Cost of feed	380.91	338.41	350.42	356.58	336.29	375.38	383.73	365.14
Cost of chicks	109.08	92.53	88.53	96.71	101.28	98.33	102.13	100.62
Sanitary and veterinary costs	9.57	7.95	8.38	8.62	7.57	8.32	9.80	8.47
Electric energy	7.08	5.22	4.25	5.52	4.11	5.93	7.37	5.80
Costs of heating	10.29	12.97	21.23	14.84	27.95	24.13	12.88	21.64
Loading of broilers	9.20	6.74	7.48	7.80	7.85	7.16	8.57	7.85
Casual, lease labour	3.58	2.19	2.26	2.68	2.85	2.21	2.62	2.54
Social insurance	1.99	1.59	1.57	1.71	1.75	1.82	2.03	1.87
Other costs	9.32	5.94	6.91	7.38	4.83	4.36	6.21	5.13
Real indirect costs	26.00	20.38	20.36	22.24	22.84	23.02	25.41	23.77
Fuel	3.85	2.63	3.06	3.18	3.59	2.85	2.95	3.13
Costs of credit	5.02	4.03	3.93	4.32	4.36	4.57	5.08	4.67
Depreciation	17.12	13.72	13.37	14.74	14.89	15.61	17.38	15.97
Total costs	567.02	493.85	511.37	524.07	517.32	550.67	560.75	542.91

Source: Own researches based on empirical data obtained from farms.

Table 4. Real production costs (EUR) of broiler chickens on farm C in selected cycles of 2005 and 2006 (per 1000 kg of livestock)

Item	Year 2005				Year 2006			
	Productive cycle			$\bar{x}$	Productive cycle			$\bar{x}$
	1	2	3		1	2	3	
	Per 1000 kg of livestock (gross)							
Direct costs	541.32	559.31	558.67	553.10	609.85	601.13	584.42	598.46
Costs of feed	371.82	366.84	377.03	371.89	399.90	395.02	387.27	394.07
Cost of chicks	115.42	122.75	111.37	116.52	121.82	114.89	123.92	120.20
Sanitary and veterinary costs	8.03	12.25	11.21	10.49	7.29	9.52	9.88	8.91
Electric energy	5.87	6.93	7.51	6.76	8.32	15.89	8.65	10.96
Costs of heating	14.49	17.12	26.10	19.24	45.87	36.58	23.97	35.47
Loading of broilers	6.74	9.92	6.11	7.58	6.80	7.26	7.44	7.16
Casual, lease labour	8.72	12.13	9.22	10.02	7.32	12.40	11.09	10.27
Social insurance	1.79	1.96	1.76	1.84	2.52	2.80	2.80	2.70
Other direct costs	8.50	9.39	8.35	8.75	10.06	6.88	9.39	8.78
Real indirect costs	12.20	14.44	12.05	12.90	17.38	12.50	15.66	15.17
Costs of fuel	1.47	2.19	1.76	1.81	1.77	3.59	1.69	2.36
Costs of credit	4.85	3.38	2.56	2.88	5.54	3.34	4.65	4.52
Depreciation	8.00	8.87	7.73	8.20	10.06	5.57	9.32	8.32
Total costs	553.50	573.75	570.72	566.00	627.31	613.70	600.07	613.68

Source: Own researches based on empirical data obtained from farms.

Table 5. The net income on farms A, B, C in selected cycles of 2005 and 2006 (EUR per 1000 kg of livestock)

Item	Net income							
	Year 2005				Year 2006			
	Productive cycle			$\bar{x}$	Productive cycle			$\bar{x}$
	1	2	3		1	2	3	
Farm A	800.30	648.69	598.98	679.76	641.68	618.58	649.38	637.06
Farm B	770.47	631.29	633.78	671.55	559.55	641.68	662.21	618.58
Farm C	286.57	77.30	41.26	135.95	-14.12	-10.52	40.55	18.22

Source: Own researches based on empirical data obtained from farms.

## Discussion

The year 2006 proved difficult for poultry producers in Poland. Favourable economic situation was disrupted in the first quarter by information about the growing number of avian influenza cases in birds approaching the Polish border. This led to a seasonal decrease in demand for poultry products resulting, among others, in a decline in procurement prices of birds for slaughter (Dybowski et al., 2006).

During the analysed period the investigated farms were generating good production results. Bird stocking density was the highest on farm B with an average of 20.8 broiler chickens per m<sup>2</sup>, which is equivalent to about 40 kg birds for slaughter per m<sup>2</sup>. However, this raises a controversy in terms of bird welfare. Research conducted by Feddes et al. (2002) and Dawkins et al. (2004) revealed that at very high stocking densities (about 46 kg of birds for slaughter per m<sup>2</sup>) it is possible to achieve satisfactory production results and maintain bird welfare if the conditions of the microenvironment meet the chicken requirements. The building on farm B had very good technical equipment and computerized systems for microclimate control. In addition, good bird production conditions on this farm were evidenced by the lowest death rate.

The highest EPI values were noted on farm B. On the other two farms the mean EPI values were slightly lower than noted in the field testing of Ross 308 broiler chickens in Poland for 2005 and 2006 (Kozłowska et al., 2006). On farm A, higher feed conversion rate per kg of weight gain was noted than in broiler chickens analysed in the field tests. According to Krawczyk et al. (2000), profitability of broiler chicken production is affected by the technical condition of the building in which the birds are housed. This may be one of the factors explaining the better rearing results obtained on farm B, since farms A and B had the same supplier of hatchlings and feed. On the other hand, broiler production results are also affected by factors such as the genetic potential of birds and feed quality (Krawczyk and Wężyk, 2002).

Comparison of the production results obtained by the farms in the broiler rearing cycles which coincided with the period of the most serious threat of influenza outbreak in wild birds in Poland, did not show any significant differences in relation to the period of time before the first cases of the disease were reported in Poland. This probably resulted from the specific character of this production. This is because both shortening and lengthening the rearing period may contribute to a decline in production profitability, among others due to economically unfavourable relationships of bird body weight to feed conversion rate necessary for its gain.

Proficiency in using the economic account, which is based on production costs, enables right economic decisions to be made concerning production on farms. The knowledge of the level and structure of costs makes it possible to analyse these costs in the horizontal and vertical planes and to find ways of their reduction (Kucka, 1999). Broiler production costs are determined by producer-dependent factors connected with technology and organization of production and by independent costs comprising, among others, the prices of agricultural means of production (Kucka, 1990; Bernard and Willett, 1998). The relationships between the procurement prices of birds for slaughter and agricultural inputs are also important (Banaś, 2004).

The analysis of production costs on the investigated farms did not reveal any notable changes in relationships between individual components of costs. The highest costs of broiler chicken rearing were on farm A. However, it was operating as an agricultural production cooperative, so this branch of production was additionally burdened with general (administrative) costs. On each farm a rise in building heating costs was noted in the rearing cycles of 2006. The changes resulted from the fact that the analysed 2006 cycles fell over the winter period. On the other hand, in response to the difficult market situation the farm owners were trying to reduce labour costs.

However, the costs of feed and hatchlings remain the most important items in the cost structure but their prices did not change favourably during the analysed period.

The net income is the basic determinant of production profitability. A decline in the income in the 2006 cycles as compared with 2005 ranged from 6 to 86%. A crucial factor shaping the net income is the price for 1 kg of chickens for slaughter offered on the market (Krawczyk et al., 2000; Banaś, 2003). In a study conducted by Banaś (2004), the net income depended mainly on the price of feeds and hatchlings (negative correlation), but the price for 1 kg of chickens for slaughter had a crucial effect on its value. Throughout 2006, the average monthly procurement price of broiler chicken for slaughter in Poland was over 13.5% lower in comparison with 2005. The lowest procurement prices of chickens were recorded in March and April, mainly because Polish consumers were anxious about contracting the dangerous avian influenza virus. In comparison with an average procurement price of 634.0 Euros throughout the year 2006, in the two months mentioned above the procurement price of chickens was an average of 608.3 and 610.9 Euros per 1000 kg in March and April, respectively (Dybowski et al., 2007). Poultry meat processing plants, with which the owners of farms A and B had signed contracts of delivery offered mean prices of 564.7 and 613.4 Euros, respectively, per 1000 kg of chickens for slaughter. The decline in price for 1000 kg of birds for slaughter caused the economic results of broiler chicken production to deteriorate in early 2006.

It is concluded that despite good production results generated on farms specializing in broiler chicken rearing, profitability of their operation declined at the beginning of 2006 when avian influenza cases were found among wild birds in Poland. The effect of market fluctuations in the prices of birds for slaughter on the profitability of broiler production has been observed but it has not been directly related to the flu epidemic. Because of the difficult market situation, the producers aimed to reduce the actual production costs of the factors which they were able to influence (e.g. noticeable reduction of labour costs).

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Accepted for printing 12 II 2009

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### **Zależność pomiędzy produktywnością i opłacalnością odchovu brojlerów kurzych a wystąpieniem ptasiej grypy u dzikich ptaków w Polsce**

#### STRESZCZENIE

Analizowano wyniki produkcyjne i ekonomiczne sześciu cykli produkcyjnych, trzech ferm prowadzących odchów brojlerów kurzych w latach 2005–2006. Trzy z nich przypadły na początkowy czas rozprzestrzeniania się grypy wśród ptaków w Europie. Pozostałe okres obejmujący stwierdzenie przypadków choroby u ptaków na terenie krajów europejskich, w tym Polski.

W wyniku zmniejszenia popytu na mięso drobiowe na początku 2006 roku nastąpiło obniżenie cen skupu żywca brojlerów. Z uwagi na trudną sytuację na rynku producenci dążyli do obniżania kosztów własnych produkcji, zanotowano obniżenie kosztów robocizny.

Mimo osiągnięcia dobrych wyników produkcyjnych opłacalność produkcji żywca pogorszyła się na początku 2006 roku, w okresie wystąpienia ptasiej grypy u dzikich ptaków w Polsce. Znalazło to odzwierciedlenie w spadku wartości dochodu rolniczego w cyklach za 2006 rok w porównaniu do 2005, w zakresie od 6 do 86%.