Avian influenza and structural change in the Czech poultry industry

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Abstract: The paper deals with the consequences of the avian influenza outbreak for the Czech poultry industry. The Hansen (1992) parameter instability test and the Gregory and Hansen (1996) residual-based test are used for testing the structural break and determining the time of the regime shift. The results provide an indication that the avian influenza outbreak might have been the reason for the changes in the value chain. However, the changes in the second stage of the value chain could also be connected with the accession of the Czech Republic to the EU. The results show that the retailers increased their market power in the second period, i.e., after September 2004. The avian influenza could be a reason for the structural break, but other factors may work together. As a result of these changes, poultry processing companies have been losing their market position, and as a consequence, the production of poultry meat in the Czech Republic has been on the decline.

Key words: avian influenza, cointegration, market power, poultry value chain, structural change

Avian influenza is a viral disease of poultry included in the OIE List A[1]. This disease can have a devastating effect on the poultry industry, particularly following high mortality rates in susceptible birds, but its presence in a given territory also results in restrictions on the animal movements, marketing and trade in poultry and poultry products (Capua et al. 2002). The sudden death of 25 000 chicken at a farm near Seoul in December 2003 was the first sign of a major epidemic of the highly pathogenic avian influenza which would disrupt the worldwide poultry industry. Nicita (2008) describes the global extent of the virus outbreaks of the virus in 2004 in Cambodia, China, Japan, Thailand and Vietnam. But the virus spread outside of the Southeast Asia, and by 2007 it had been confirmed in numerous European, African and Middle Eastern countries (Nicita 2008). Swayne and Kapczynski (2008) show that since 1959, there have been 26 outbreaks or epidemics of the high-pathogenicity avian influenza in poultry and other birds of the world, but only four used a combination of focused depopulation and vaccination to eliminate the clinical disease and to maintain the economic viability of poultry production. Many papers deal with different aspects of the disease: expansion of the highly pathogenic avian influenza (Gauthier-Clerc et al. 2007), the safety and quality of poultry meat (Mulder 2004), a genetic strategy for the future (Chen et al. 2008), the efficacy of vaccination and human health implications (Capua et al. 2002; Sarikaya and Erbaydar 2007; Capua and Alexander 2008; Swayne and Kapczynski 2008; Busani et al. 2010), modelling the worldwide spread (Colizza et al. 2007), or the economic effects of the avian influenza outbreaks (Brown et al. 2007; Djunaidi and Djunaidi 2007; Yalcin et al. 2010).

The outbreak of the avian influenza in Asia in 2004 and one year later in Europe had a devastating worldwide forecast, with respect to the poultry industry and to poultry producers in particular. The real effect was not as strong as anticipated and differed among regions and countries, as the case may be. The relevant question at present concerns the real consequences of the disease outbreak on the poultry industry. More specifically, at least two important questions should be addressed by the research. The

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[1]OIE List A – The World Organization for Animal Health (OIE), List A – Transmissible diseases that have the potential for very serious and rapid spread, irrespective of national borders, have serious socio-economic or public health consequences, and are of major importance in the international trade in animals and animal products. Available at http://www.oie.int/about-us/.

first question concerns the impact of the disease on the consumption and production of poultry meat. The second question relates to changes in the price transmission due to the changes in market structure. In this paper, we try to address the second question in the case of the Czech poultry industry.

Changes in the market structure can take on different but mutually dependent forms. However, the crucial question concerns changes in market power in both stages of the value chain. More specifically, in this paper we will elaborate the following question, for both the market for raw materials and the market for the processed products: Did the processing companies gain market power during the period of structural change or did they lose it?

The poultry industry became the fastest developing industry in the Czech agri-food sector over the last two decades, and it is currently one of the most important industries in the Czech agri-food system. Consumption of poultry meat increased from 17.9 kg/capita/year in 1998 to 25 kg/capita/year in 2009. Production increased from 241 000 tons of live weight in 1998 to 275 000 tons of live weight in 2009. In addition, the turnover of the foreign trade in poultry rose significantly. However, changes in the foreign trade were favourable to imports. The share of imports in the total domestic consumption increased from 6.5% in 1998 to 27.3% in 2009. In 1998, the exports of poultry meat were 50% as large as imports, whereas in 2009 they reached only 36.6% of the total imports of that commodity.

MATERIAL AND METHODS

Theoretical framework

Considering the relationships between the stages of the poultry value chain, we can assume that the marketing margin model (applications, e.g., Jumah 2000; Bojnec 2002; Bakucs and Ferto 2006; Clark and Čechura 2011) provides a good approximation of the price transmission for the analysis of the change in market power.

The model stands on the assumptions that the product is homogenous and the production is characterized by a constant return to scale (see McCorriston et al. 2001 on the relation between market power and return to scale with respect to the price transmission elasticity).[2] Moreover, we assume that there is a long-term relationship between prices, which in fact represents the subgame equilibrium.[3]

The marketing margin model explains the difference between the wholesale price and the farmer price, or between the consumer price and the wholesale price, respectively, i.e., the price margin (or spread) between the two stages of the value chain. We write the price margins as:

$$M1_t = WP_t - FP_t \tag{1a}$$

$$M2_t = CP_t - WP_t \tag{1b}$$

where $t = 1,..., T$, $M1_t$ stands for marketing margin (price spread) between wholesale price (WP_t) and farmer price (FP_t), and $M2_t$ represents the margin between consumer price (CP_t) and wholesale price.

An explanation for the margin can be arrived at from the side of either the farmer or the processing company, depending on the nature of the price creation. Given the results of other studies (Čechura 2006; Bečvářová 2008), we assume that the price is determined on the wholesale level for $M1_t$ and on the consumer level for $M2_t$. That is, the mark-down model is the relevant representation:

$$M1_{dt} = \alpha_1 + \beta_1 FP_t \tag{2a}$$

$$M2_{dt} = \alpha_2 + \beta_2 WP_t \tag{2b}$$

where $M1_{dt}$ and $M2_{dt}$ are the mark-downs in time t. The absolute term α_i, for $i = 1, 2$, represents marginal costs, and the slope parameter β_i ($0 \le \beta_i < 1$) shows the power of processing producers and retail companies, respectively. The slope β_i expresses how much the marketing margin can be increased due to the market power of processing producers (β_1) and retail companies (β_2), respectively.

By substituting (2a) for $M1_t$ into (1a) and expressing for FP_t, we get:

$$FP_t = -\frac{\alpha_1}{1+\beta_1} + \frac{1}{1+\beta_1} WP_t \tag{3a}$$

If we do the same for the second relation, i.e. substituting (2b) for $M2_t$ into (1b) and expressing for WP_t, we obtain:

$$WP_t = -\frac{\alpha_2}{1+\beta_2} + \frac{1}{1+\beta_2} CP_t \tag{3b}$$

The slope parameter in relation (3a) and (3b) reduces to 1, if the parameter β_i is equal to 0. This situ-

[2]Čechura (2009) found that farmers with animal production and meat producers operate in the region with a constant return to scale.

[3]This assumption is tested in the empirical part of the paper.

ation is consistent with a perfect price transmission. However, if the parameter β_i is not equal to 0, the slope parameter in (3a) and (3b) is smaller than 1. In this case, there is an indication of the abuse of market power. Moreover, if the prices are in logarithms, the slope parameter in relation (3a) and (3b) represents the corresponding price transmission elasticity.

Finally, in our empirical analysis we assume that the equilibrium relationship is characterized by a certain level of marketing cost (processing, storage, advertising, transport, etc.) and possibly by a non-zero percentage mark-down β_i. If there is a change in the environment, there might be a change in the long-term relationship. The change can be in the intercept of the model (3a) or (3b), as the case may be, i.e., in the shift parameter, due to the change in marketing costs, and/or in the slope, i.e., in the percentage mark-down. The change in the intercept can be interpreted as a change in capacity, among other things. The change in the slope parameter might be interpreted as a change in market power. Processing or retail companies may decide to charge a different percentage mark-down as a reaction to the changes in the environment, in our case as a consequence of the avian influenza outbreak.

Estimation strategy[4]

The theoretical models (3a) and (3b) will be estimated and then tested to see how these relationships or the market power, respectively, may have changed over time. The estimation strategy is predetermined by our assumptions about the possible instability of the relation between the stages. Assuming that the avian influenza outbreak might have changed the relations between stages, we test for the parameter stability. However, since the applicability of the parameter stability test depends on the nature of the time series (stationary vs. non-stationary time series), we first test for the order of integration I(d) of the price time series. We then apply the parameter stability test and, finally, estimate and analyze our model specifications (3a) and (3b).

We use an (A)DF ((Augmented) Dickey Fuller) test (Dickey and Fuller 1979) to determine the order of integration, I(d). We supplement the ADF test by the KPSS (Kwiatkowski-Phillips-Schmidt-Shin) test (Kwiatkowski et al. 1992) for the cases when the ADF test does not provide unambiguous results.

If the time series are non-stationary (usually integrated of order 1 or 2), the consequent question is whether the time series are co-integrated, i.e., whether there is a long-term relationship between (among) the analyzed time series. We use the Engle-Granger two-step approach (Engle and Granger 1987) to test for the co-integration.

Since Chow (1960) and Quandt (1960), the literature related to structural change has grown considerably (e.g. Hansen 1992, Andrews 1993, Andrews and Ploberger 1994, Gregory and Hansen 1996, Bai and Perron 1998 and others). Modern methods include threshold estimation methods (e.g., Hansen 2000a; Caner and Hansen 2001). The tests differ in their power and applicability. The basic classification involves: known vs. unknown timing of the breakpoint; type of regressor, $I(d)$, and the number of breakpoints (Maddala and Kim 1998).

We use the Hansen (1992) test since the test includes cases where the breakpoint is unknown and the regressors are I(1), as opposed to, e.g., Chow (1960). However, Carrion-i-Silvestre and Sansó-i-Rosselló (2006) show that using the FMM (Fully Modified Method) results in a test with poor finite sample properties. The Gregory and Hansen (1996) test is therefore carried out, which can be considered a complementary test to Hansen (1992). The Gregory and Hansen (1996) test procedure is based on the OLS method.

Moreover, the question for the application is: How many structural breaks shall we assume? The Hansen (1992) and Gregory and Hansen (1996) tests are intended for testing one structural break only. However, it may be the case that the system underwent multiple structural changes. Kejriwal and Perron (2008) state that "the single break test can suffer from non-monotonic power when the alternative involves more than one break". Unfortunately, the set oftests for multiple structural changes is limited. Bai and Perron (1998) developed a test for multiple structural changes that is, however, composed for stationary time series. Since the tests developed in a stationary context exclude structural change in the marginal distribution of the regressors (see Hansen 2000b), they are not applicable for nonstationary variables. Other examples include Hansen (2003), Qu (2007), Kejriwal and Perron (2008), or in the Bayesian approach, e.g., Holbert (1982). Hansen (2003) introduces a test for multiple structural changes in a cointegrated system with known break dates, which is a weakness of this test because of endogenizing the breakpoint (see, e.g., Perron 1989). Qu (2007) suggested a test for cointegration under changes in the cointegrating vector at unknown multiple dates. Kejriwal and Perron (2010) undertook

[4]All calculations are carried out in GAUS.

a similar treatment as Bai and Perron (1998), but in models with both I(I) and I(O) variables. Thus only this test is applicable for non-stationary time-series and multiple structural changes.

Since we assume that there is only one significant reason for the structural break in the analyzed relationship, i.e., the avian influenza outbreak, we use the Hansen (1992) test in our empirical part, and to complement it with the Gregory and Hansen (1996) test to determine the stability of the system. The potentially computed global extremes of the tests are considered candidates for the structural break. The candidates are then confronted with the prior information. As mentioned by Maddala and Kim (1998), "if a search is conducted, it should be around the events", since the criticism of Perron (1989) and its followers on endogenizing the breakpoint is not fully justified.

Tests for parameter instability

Hansen (1992) proposed three tests – SupF, MeanF, and Lc – for testing the parameter instability in econometric models. All tests are of the same null hypothesis – i.e., the parameter stability – but they differ in their choice of the alternative hypothesis. Since the tests are looking in different directions and have more power with some alternatives than others, they could be in conflict with each other. Whereas the SupF test has the power to detect the occurrence of a swift shift in regime, the MeanF and Lc tests are appropriate to simply test the stability of the relationship described by the model. Moreover, the Lc test is a test of the null of cointegration against the alternative of no cointegration. Since the tests are based on the Phillips-Hansen fully modified estimator, the estimates of cointegrating vectors are asymptotically efficient.

Gregory and Hansen (1996) proposed extension of the ADF, Zt and Zα test (we denote the extended versions of the tests – ADF*, Zt* and Zα*) for the cointegration with regime shift in either the intercept or the entire coefficient vector. The tests test the null of no cointegration against the alternative of cointegration in the presence of a possible regime shift, a break of unknown timing. Three forms of structural change are considered by Gregory and Hansen (1996):

Level shift model – C

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \alpha^T y_{2t} + e_t \qquad t = 1, \ldots, n \qquad (4)$$

Level shift model with trend – C/T

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \beta t + \alpha^T y_{2t} + e_t \qquad t = 1, \ldots, n \qquad (5)$$

Regime shift model – C/S

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \alpha_1^T y_{2t} + \alpha_2^T y_{2t}\varphi_{t\tau} + e_t \qquad t = 1, \ldots, n \quad (6)$$

where y_{1t} is real-valued and y_{2t} is an m-vector of I(1) variables, e_t is I(0). The parameters μ and α describe the m-dimensional hyperplane towards which the vector process $y_t = (y_{1t}, y_{2t})$ converges over time.

The dummy variable is defined as:

$$\varphi_{t\tau} = \begin{cases} 0 & if \quad t \le [n\tau] \\ 1 & if \quad t > [n\tau] \end{cases} \qquad (7)$$

where $\tau \in (0,1)$ is the unknown parameter which denotes the (relative) timing of the breakpoint, and [ ] denotes the integer part.

The first case (4) represents a level shift in the cointegrating relationship, the second (5) a level shift with trend, and relation (6) allows the slope vector to shift as well. The last case allows the equilibrium relation to rotate as well as the shift parallel (for further reference see Gregory and Hansen 1996).

Data

The data used in the analysis were drawn from the database of the Czech Statistical Office. We use the monthly price time series of farmer price, wholesale price and consumer price in the period from January 1994 till December 2009.

RESULTS AND DISCUSSION

Development of prices and price spreads

Figure 1 presents the farm price, wholesale price and consumer price development between January 1994 and December 2009. The basic patterns, i.e., local extremes, are identical for all prices. Different peaks and valleys occurred for different reasons, and caused the time series to have a rather stochastic trend. The wholesale and consumer price exercised a higher volatility compared to the farm price. The variability of prices was higher before the Czech Republic's accession to the European Union. In addition, a higher average farm as well as wholesale and consumer price can be observed before the EU accession period.

Figure 2 shows the development of price spreads between the wholesale price and farm price (Margin – stage 1) and between the consumer price and wholesale price (Margin – stage 2). The price spread development is rather stochastic before the EU accession.

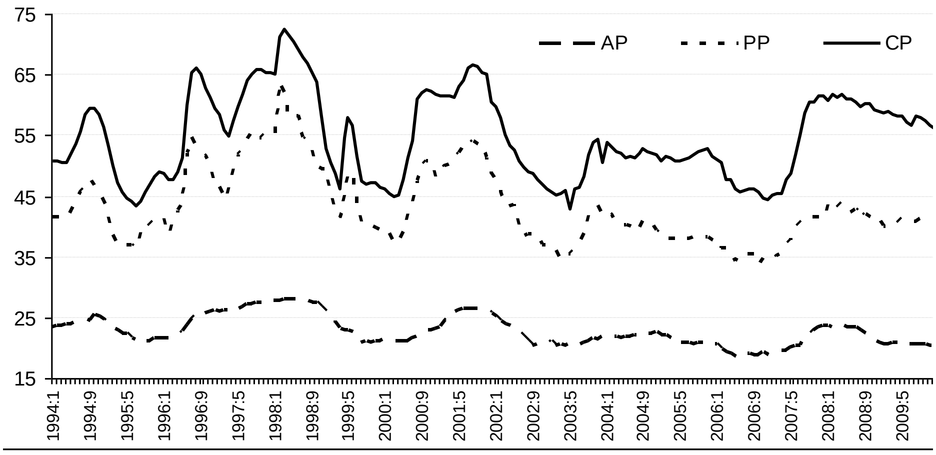

Figure 1. Farm price, wholesale price and consumer price

AP = farm price, PP = wholesale price, CP = consumer price

Source: Czech Statistical Office

The pattern of the development can be deduced from the price development. This suggests that no significant changes, in terms of the market power change, occurred in this period. The spread's volatility decreased after the EU accession. This observation is again consistent with the price development. However, a significant shift occurred at the end of the analyzed period, approximately in the middle of 2007. The shift in both margins suggests an episode of structural change in the markets that could have changed the market structure.

Econometric analysis

We start the empirical part of our paper with testing the order of integration of the farmer (FP), wholesale (WP) and consumer price (CP) time series. Table 1 presents the ADF test statistics for different lags and deterministic assumptions. As expected, we obtained different results for different lags and deterministic assumptions. The time series seems to be stationary in levels in some cases, while in other cases the opposite is true. The wholesale price is an exception. The wholesale price in levels is non-stationary in all cases. The KPSS test suggests that the farm (KPSS test statistic with 2 lags: 0.23) and consumer price (KPSS test statistic with 2 lags: 0.25) is a mixture of stochastic and deterministic trends, which is not a contradiction of the ADF result. In light of these results and the fact that the differenced time series are stationary in all cases, we conclude that the wholesale price is integrated of order I(1) and the farmer price and consumer price are integrated of order I(1) with a trend.

The cointegration analysis showed that according to the Dickey-Fuller test for cointegration (Engle-Granger two-step procedure), the time series FP

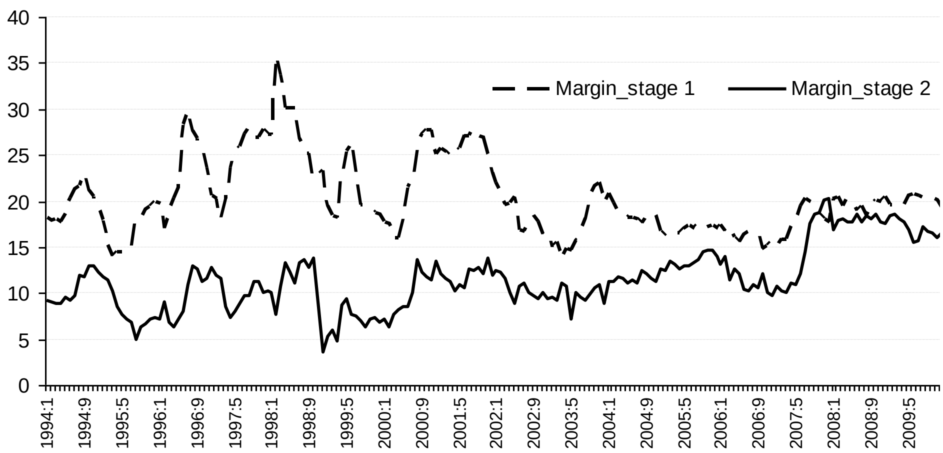

Figure 2. Changes in price spreads (margins) within the Czech poultry market

Source: Czech Statistical Office and own calculations

Table 1. Augmented Dickey-Fuller (ADF) unit root test

ADF test		lFP	dlFP	logWP	dlogWP	logCP	dlogCP
	no intercept	−0.38	−4.78***	−0.17	−6.52***	0.01	−6.61***
2 lags	intercept	−2.69*	−4.78***	−2.57	−6.50***	−3.60***	−6.60***
	intercept and trend	−3.39*	−4.77***	−3.03	−6.49***	−3.60**	−6.58***
	no intercept	−0.45	−3.20***	−0.32	−4.94***	−0.88	−4.68***
6 lags	intercept	−2.84*	−3.22**	−2.33	−4.93***	−3.17**	−4.66***
	intercept and trend	−3.63**	−3.21*	−2.71	−4.92***	−3.16*	−4.65***
	no intercept	−0.21	−4.02***	−0.13	−3.68***	0.06	−3.74***
12 lags	intercept	−2.15	−4.00***	−2.57	−3.67***	−3.30**	−3.73***
	intercept and trend	−3.57**	−4.01***	−3.34*	−3.67***	−3.31*	−3.71**

Source: Own calculation

and WP are cointegrated but only at a 10% level of significance, and the time series WP and CP are not cointegrated (Tables 2 and 3). That is, we found a lack of cointegration, or no cointegration in the analyzed relations that might be caused by the presence of a structural shock, which we assume to be present due to the avian influenza outbreak. In that case, the time series could be cointegrated with the structural break.

The Hansen (1992) parameter instability tests provide the following results: for the relation between FP and WP (i.e., the first stage of the poultry value chain) – Lc (0.3195), MeanF (6.4892) and SupF (31.9730); and for the relation between WP and CP (i.e., the second stage of the value chain) – Lc (0.3259), MeanF (11.3385) and SupF (102.3082). The null hypothesis (i.e., parameter stability) is rejected at the first stage by the SupF test (even at a 1% significance level) and at the second stage by the MeanF and SupF tests (also at a 1% significance level). Since the tests are looking in different directions (i.e., differ in their choice of the alternative hypothesis) and might be in conflict with each other, we concentrate on the results of the SupF test. The SupF test has the power to detect whether a swift shift in regime occurred. This alternative hypothesis is relevant for both the additional Gregory and Hansen (1996) residual-based tests and the subsequent estimation of the theoretical model.

Based on the results of the SupF test, we can say that a regime shift in the analyzed relation occurred. That is, we reject the null hypothesis of the standard model of cointegration with the implicit assumption of the long-term stability of the cointegrating vector. However, there could be two cointegrating regimes which shifted at a particular time in the period under investigation.

Figures 3 and 4 show the recursively estimated statistics of the SupF test. Both figures suggest that the regime shift occurred after 2007. The exact time and nature of the shift will be determined together with the Gregory and Hansen (1996) residual-based test, since the Gregory and Hansen (1996) test has better finite sample properties.

Table 2 presents the Gregory-Hansen ADF*, Zt* and Zα* tests for cointegration with the regime shift

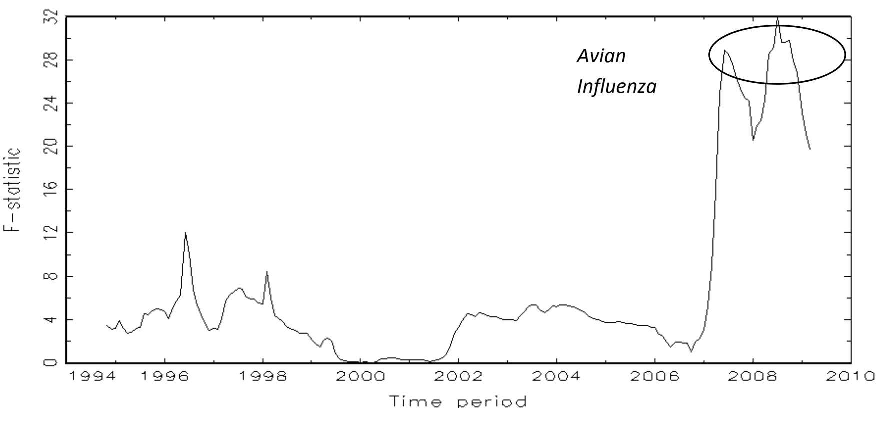

Figure 3. Hansen parameter instability test – SupF test – logFP and logWP regression

Source: Own calculation

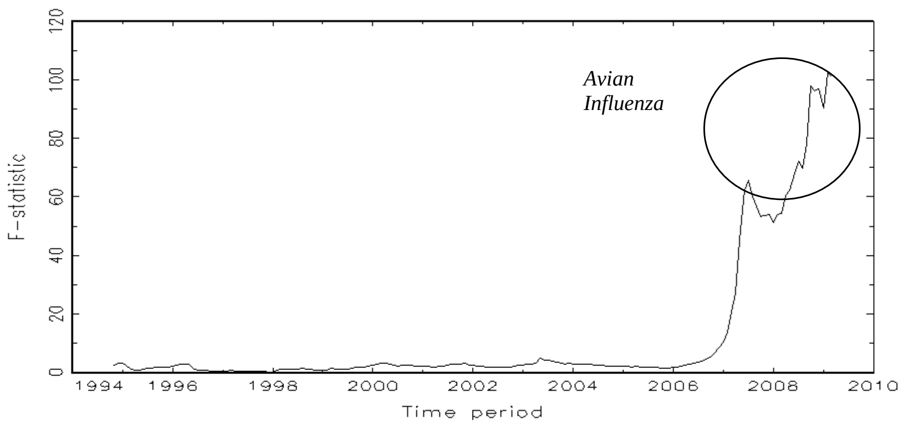

Figure 4. Hansen parameter instability test – SupF test – logWP and logCP regression

Source: Own calculation

in FP and WP regression, i.e., for the first stage of the poultry value chain. Only the ADF* test suggests that the regime shift occurred at a 5% significance level. This result is therefore in favour of cointegration with the structural break, i.e., with regime shift in both the intercept and slope parameter. The breakpoint is situated at July 2007. That is, the Hansen (1992) and Gregory and Hansen (1996) tests provide approximately the same results. The breakpoint is situated at the time when the avian influenza was detected in the Czech Republic. In other words, the test suggests that the avian influenza detection in the Czech Republic caused a significant parameter instability.

Table 3 presents the Gregory-Hansen tests for cointegration with the regime shift in WP and CP regression. In this case, all three tests reject the null hypothesis at a 5% significance level in all cases. Thus, contrary to the conventional ADF test (Engle-Granger two-step procedure), these results are in favour of cointegration with the structural break. However, the breakpoint is situated at a different period compared to the Hansen (1992) test. With respect to the finite sample properties, the exact time is determined by the Gregory and

Table 2. Gregory-Hansen cointegration test – testing for regime shifts in the Czech poultry industry – logFP and logWP regression

	Test statistic	Breakpoint
ADF	−2.83627*	–
ADF*		
C (with 13 lags)[1]	−4.27724	0.28646
C/T (with 13 lags)[1]	−4.26526	0.30729
C/S (with 2 lags)[1]	−4.99634**	0.84375
Zt		
C	−4.26826	0.16146
C/T	−4.64338	0.47917
C/S	−4.49780	0.83333
Za		
C	−34.90523	0.16666
C/T	−40.13903	0.47917
C/S	−37.00908	0.82813

[1]Number of lags determined by BIC (Bayesian Information Criterion)

Source: Own calculation

Table 3. Gregory-Hansen cointegration test – testing for regime shifts in the Czech poultry industry – logWP and logCP regression

	Test statistic	Breakpoint
ADF	−0.623521	–
ADF*		
C (with 13 lags)[1]	−5.02192**	0.66667
C/T (with 13 lags)[1]	−6.35049***	0.19271
C/S (with 2 lags)[1]	−5.75217***	0.66667
Zt		
C	−4.99473**	0.67188
C/T	−6.34771***	0.19271
C/S	−5.76728***	0.66667
Za		
C	−44.59428**	0.67188
C/T	−66.18517***	0.19271
C/S	−57.05820***	0.66667

[1]Number of lags determined by BIC (Bayesian Information Criterion)

Source: Own calculation

Table 4. Estimates of the parameters of the farm to wholesale marketing margin from Engle-Granger Cointegrating regression – FP and WP regression

Period: 01:1994–06:2007			Period: 07:2007–12:2009		
Variable	coefficient	*p*-value	variable	coefficient	*p*-value
Intercept1	2.3764	0.0000	Intercept2	2.2500	0.0008
LogWP1	0.1966	0.0000	LogWP2	0.2287	0.1978
RHO	0.9765	0.0000	SSR	0.0556	
R2	0.9742		SEE	0.0172	

Source: Own calculation

Hansen (1996) test. Since the breakpoint is the same for all C/S specifications, we conclude that the regime shift in the relation between WP and CP occurred in September 2004. The breakpoint is situated at a time which could be connected with the second wave of the spread of the H5N1 virus (see the discussion below). However, this change could also be connected with the Czech Republic's accession to the European Union.

In the last part of our analysis, we investigate the impact of the structural breakpoint or the avian influenza outbreak, respectively, on the changes in market structure (market power) in the poultry value chain. The models with a regime shift (C/S) in July 2007 – FP and WP regression – and in September 2004 – WP and CP regression – as the Gregory-Hansen tests for cointegration suggested, were re-estimated due to the fact that the tests are based on the OLS estimates which might not be asymptotically efficient. The GLS method with the control for autocorrelation of the first order (estimation by Hildreth-Lu Search) is therefore used.

Table 4 provides the parameter estimates for the first stage, i.e., farm to wholesale marketing margin, and the regime shift in July 2007 when the parameter instability was detected. The estimates show that the intercept is slightly lower and the slope parameter is to some extent higher in the second period, i.e., after the structural break. Since the change in the slope parameter can be interpreted as a change in market power, the results suggest that the processors lost some of their market power. However, since the change in the slope parameter is only minor and, more importantly, the parameter is not statistically significant, the change in market power could have been rather small. The change in the intercept suggests that the level of marketing costs went down. This could be an indication that Czech poultry producers lost part of their market position as a result of the avian influenza outbreak.

Table 5 presents the parameter estimate for the relation between the wholesale and consumer prices with a regime shift located at September 2004. The estimate shows that both intercept and slope parameter changed significantly. The change in the intercepts indicates that the level of marketing costs increased, and the change in the slope parameter provides an indication that the retailers increased their market power after the structural break in September 2004. That is, food processing companies face a higher market imperfection in the market for processed products.

CONCLUSIONS

The first case of the avian influenza outbreak was recorded in 1997 in Hong Kong. Since it did not

Table 5. Estimates of the parameters of the wholesale to consumer marketing margin from Engle-Granger Cointegrating regression – WP and CP regression

Period: 01:1994–09:2004			Period: 10:2004–12:2009		
Variable	coefficient	*p*-value	variable	coefficient	*p*-value
Intercept1	0.5689	0.0057	Intercept2	2.1731	0.0002
LogCP1	0.7984	0.0000	LogCP2	0.3919	0.0073
RHO	0.9338	0.000	SSR	0.1051	
R2	0.9713		SEE	0.0237	

Source: Own calculation

spread significantly, it did not receive any special attention. However, the first large wave of the avian influenza outbreaks in 2003 in Asian countries had a devastating effect. The third wave occurred one year later, in mid-2004. At this time, new outbreaks of the disease were reported in Asia and Canada. The fourth wave took place in 2005. This outbreak was extensive, affecting almost all of Asia, and it spread worldwide. In mid-August 2005, there were reports of the occurrence of the avian influenza in Russia and later in the European Union. The first outbreak of the avian influenza in the Czech Republic was recorded in 2006, in the production of swans in Southern Bohemia and Southern Moravia. In June 2007, the virus first appeared in poultry, in ZOD Zálši Tisova.

The results provide an indication that the avian influenza outbreak might have been the reason for the changes in the value chain. However, the changes in the second stage of the value chain could also be connected with the accession of the Czech Republic to the EU.

Considering the results from both the market for raw materials and the market for processed products, we may conclude that the retailer stage increased its market power in the second period, i.e., after September 2004. The avian influenza could be a reason for the structural break, but other factors may be working together with it. As a result of these changes, the poultry processing companies have been losing their market position, and as a consequence the production of poultry meat in the Czech Republic has been declining.

Figures concerning the domestic production and foreign trade confirm that Czech poultry producers have lost their market position. The production of poultry meat dropped between the years 2005 and 2009 from 321 700 to 270 500 tons. Imports increased greatly between the years 2003 and 2004, namely from 43 500 to 72 400 tons. Imports then increased at a lower rate, up to 108 400 tons in 2009. Exports also rose, from 17 200 tons in 2004 to 34 400 tons in 2009; however, this did not compensate for the dramatic increase in the import quantities. That is to say, the changes in the Czech poultry industry seem to be permanent rather than transitory.

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