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Time Series Properties and Their Influence on the Results of Price Transmission – Case Study of the Czech Pork Market

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Anotace

Tento článek zkoumá vlastnosti vybraných časových řad a dopad volby časové řady pro výsledky cenové transmise ve zvolené zemědělsko-potravinářské vertikále. Analýza se zabývá otázkou, zda výběr časové řady může ovlivnit výsledky cenové transmise. Analýza je zaměřena na vertikálu vepřového masa v České republice, je tedy zkoumána cena zemědělských výrobců, cena potravinářských výrobců a spotřebitelská cena vepřového masa. Nejprve jsou zkoumány vlastnosti a charakteristiky zvolených časových řad a následně je provedena analýza cenové transmise na základě časových řad o různé frekvenci a v různých časových obdobích. Analýza cenové transmise je založena na analýze vícerozměrných časových řad, konkrétně je použit Model korekce chyby a kointegrační analýza. Analýza neprokázala významný dopad frekvence časové řady na výsledky cenové transmise, zatímco vliv délky období se na základě provedené analýzy jeví jako významný.

Klíčová slova

Časová řada, cenová transmise, vepřové maso, kointegrační analýza, Model korekce chyby.

Abstract

This paper deals with an examination of the selected time series and an examination of price transmission in the selected agri-food chain. The analysis is connected with the working question of whether the selection of time series influences the results of price transmission. The analysis is focused on the pork agri-food chain in the Czech Republic; the time series of farm-gate price, wholesale price and consumer price is examined. First of all, the main properties of the selected time series are examined; subsequently, price transmissions based on time series of different frequency and in different periods are analyzed. The price transmission analysis is based on multivariate time series analysis; to be precise, the Vector error correction model and co-integration analysis are employed. The analysis shows that the choice of time series of different frequency should not significantly influence the results of price transmission, whereas the choice of time period might be crucial.

The results presented in this paper are outputs of the research project “P402/11/P591 Modelling of price transmission and its asymmetry in agri-food chain – theoretical-empirical implications” supported by Czech Science Foundation.

Key words

Time series, price transmission, pork meat, co-integration analysis, Vector error correction model.

Introduction

Price transmission in agri-food chains is a current topic with a relatively short history, especially in Central European countries. Nevertheless, the examination of price transmission is crucial, for example, at the level of national agricultural policy. The analysis of agri-food chains is usually based on time series analysis. For such an analysis, several features should be considered and examined. First, the nature of the selected time series based on the main statistical characteristics of the time series should be examined, as well as the short-term and long-term components of the time series. Then, its own price transmission should be examined and described. For price transmission analysis of the agri-food chain, it is also crucial to know the primary characteristics of the analyzed chain.

The pork sector, which was selected for the following analysis, is one of the most important agri-food chains, and not only in the Czech Republic. Many

authors have shown its importance for the national economy as well as the whole world. Malý et al. (2011) mentioned that the strong position of pork is connected with the customs and habits of the Czech people. The importance and features of the pork agri-food chain was also processed and published by Babović et al. (2011), among others.

The time series of prices are crucial for price transmission analysis. Matošková (2011) says that significant price volatility has been observed in global agri-food markets. She also mentioned that price is a motivating power in the development of supply and demand in global markets. She also mentioned that supply in agrarian markets can be characterized by low elasticity to actual production. Furthermore, production changes every year pursuant to variable weather conditions. In general, demand for basic agri-food commodities has increased steadily in line with population growth, and this does not indicate higher flexibility. The low demand elasticity of agri-food products means that a relatively small variability in production volume can induce significant changes (so-called shocks) in supply and demand, and consequently in price levels. Volatility in the prices of food products was also analyzed by, for example, Onour, Sergi (2011). Clark, Čechura (2011), among others, say that an examination of the features of a time series could be critical for time series analysis. Some seasonal components, as well as cyclical components or unexpected shocks, could influence the results.

This paper deals with vertical price transmission in the pork agri-food chain in the Czech Republic; therefore, the following literature review is focused on papers dealing with an analysis of vertical price transmission. The first studies of vertical price transmission were introduced by Heien (1980), Boyd, Brorsen (1985), and Kinucan, Forker (1987), among others. Later, vertical price transmission in meat agri-food chains was analysed by, e.g., Azzam (1999), Goodwin, Harper (2000), Peltzman (2000), Bojnec (2002), Lloyd et al. (2004), and Bakucs, Fertö (2005). Advanced techniques and new knowledge concerning the relevant topic in the current period were introduced and presented by Vavra, Goodwin (2005), Bunte, Vavra (2006), Lechanová (2006), and Jensen, Møller (2007), among others.

Vavra, Goodwin (2005) analyzed vertical price transmission in meat agri-food markets in the USA using co-integration analysis, the Vector Error Correction Model, and the Threshold Vector Error Correction Model. The analysis showed that price transmission in the pork agri-food chain is asymmetric. Bunte, Vavra (2006) analyzed vertical price transmission in meat agri-food chains in several countries using the Threshold Vector Error Correction Model. Analysis of price transmission in the pork agri-food chain in the Czech Republic showed that price transmission is asymmetric at all levels of the analyzed agri-food chain. Lechanová (2006) analyzed vertical price transmission, with an emphasis on supply and demand shocks in meat agri-food chains in the Czech Republic. The analysis showed inelastic and asymmetric reactions between pork prices.

Material and methods

The ***objective*** of the paper is to examine whether the choice of time series influences the results of the price transmission analysis. Thus, the working question of whether *the choice of time series may influence the results of the price transmission analysis* should be answered.

This hypothesis is based on the assumption that some specific features of individual time series may influence the nature of price transmission. For instance, some frequency of the time series may show a seasonal or cyclical component while the other frequencies do not. Also, one could assume that the length of the time series is crucial for price transmission analysis due solely to the number of observations and the different properties of the time series. The hypothesis is verified in a case study of the pork agri-food chain in the Czech Republic. If the hypothesis is accepted for the pork agri-food chain, then the same results could be anticipated for other agri-food chains.

The analysis is separated into two parts. First of all, time series frequency and its influence on price transmission are examined and subsequently, time series properties and their influence on price transmission are examined. The first part is based on the time series of the farm-gate price and wholesale price of pork, and the second part is focused on the wholesale price and consumer price of pork. Thus, results concerning the whole vertical price transmission could be defined based on the selected time series; i.e., price transmission between farm-gate price, wholesale price and consumer price in the pork agri-food chain.

The ***empirical part*** consists of the following steps:

1. Examination of the selected time series:

i. description of the main statistical characteristics of the selected time series;

ii. evaluation of extreme values of the selected time series;

iii. examination and description of short-term variation in the time series;

iv. examination and description of the long-term tendency of the time series.

2. Examination of price transmission between the selected time series:

i. the selection of maximal lag using the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC);

ii. examination of time series stationarity using the Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP);

iii. detection of a long-term relationship between selected variables using cointegration analysis;

iv. description of the long-term relationship between selected variables in cases where this relationship is proven; for this purpose, the Vector Error Correction Model (VECM) is employed in the following form:

$$\Delta X_t = \eta + \Pi X_{t-1} + \sum_{s=1}^{p} C_s \Delta X_{t-s} + U_t \ ,$$

where $C_s = 0$ for $s > p$, X_t is a k x 1 vector of variables which are supposed to be integrated of order 1, (I(1)), u1, …, ut are nid (0,∑) and Π is a matrix of the long-run relationships;

v. processing of additional tests (test of exclusion, test of stationarity, and test of weak exogeneity are employed to verify the additional characteristics of selected variables and relationships of the model) and residual analysis (calculation and interpretation of information criteria, multicollinearity, autocorrelation of residuals, normality of distribution and heteroskedasticity is employed to verify statistical characteristics of the derived model);

vi. description and explanation of the nature of the price transmission based on the coefficient of price transmission elasticity.

Results and discussion

The paper is focused on price transmission analysis in the pork agri-food chain in the Czech Republic. An econometric approach which uses time series analysis is employed for this purpose. Therefore, it is crucial that the first step of the analysis be an examination of the selected time series. The following text first examines the time series frequency and its influence on the results of price transmission between farm-gate price (FP) and wholesale price of pork leg without bones (WP); subsequently, an examination of time series properties and their influence on price transmission between wholesale price of pork leg without bones (WP) and consumer price of pork leg without bones (CP) is provided.

I. Time series frequency

1. Description of selected time series

The main statistical characteristics of the analyzed time series are shown in Table 1. The mean value of farm-gate price equals 38.95 CZK/kg in the case of monthly data and 39.40 CZK/kg in the case of bi-weekly data. The mean value of wholesale price reaches a value of 87.89 CZK/kg in the case of monthly data and 88.35 CZK/kg in the case of bi-weekly data. Based on the table it is clear that the relative variation in farm-gate price time series is higher than the relative variation in wholesale price time series in both cases – the variation coefficient of farm-gate price time series equals 10.21 % in the case of monthly data, and 11.01 % in the case of bi-weekly data, while the variation coefficient of wholesale price time series reaches values of 7.24 % and 8.26 %, respectively.

Table 2 shows the minimal and maximal values of both the farm-gate and wholesale price of pork in the analyzed period in the case of monthly data, as well as bi-weekly data. The table shows slight differences between the monthly and bi-weekly extreme values. However, these differences are not fundamental. The minimal value of farm-gate price equals approximately 29 CZK/kg in both cases, while the maximal value reaches approximately 48 CZK/kg. The extreme values of wholesale price show larger differences than farm-gate price extremes. The minimal value of wholesale price in the case of monthly data equals almost 75 CZK/kg, while its maximal value equals approximately 103 CZK/kg. The minimal value of wholesale price based on bi-weekly data equals approximately 73 CZK/kg, while its maximal value equals almost 107 CZK/kg. Moreover, these extreme values were reached in approximately the same periods. The minimum of farm-gate price in the case of monthly data was reached in February 2004, whereas the minimum of wholesale price was reached in May 2010. Maximal values of both farm-gate price and

	Monthly data				Bi-weekly data		
	Mean (CZK/kg)	Std. deviation	Variation coefficient (%)		Mean (CZK/kg)	Std. deviation	Variation coefficient (%)
FP	38.95	3.98	10.21	FP	39.40	4.34	11.01
WP	87.89	6.37	7.24	WP	88.35	7.30	8.26

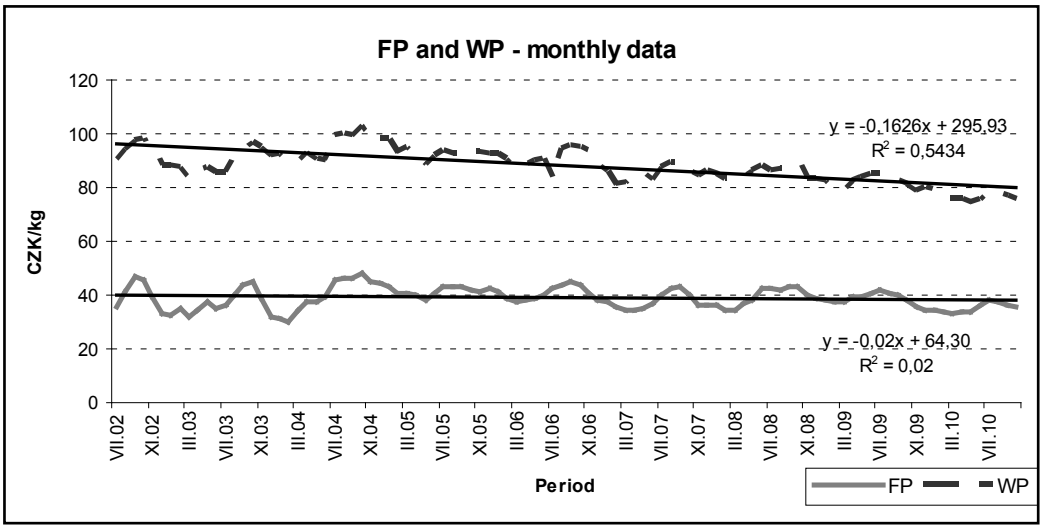
Source: own calculation

Table 1: Statistical characteristics of selected variables.

	Monthly data			Bi-weekly data	
	Min. value	Max. value		Min. value	Max. value
FP	29.70	47.88	FP	29.23	48.62
WP	74.64	103.02	WP	72.61	106.74

Source: own calculation

Table 2: Minimal and maximal values of selected time series (CZK/kg).



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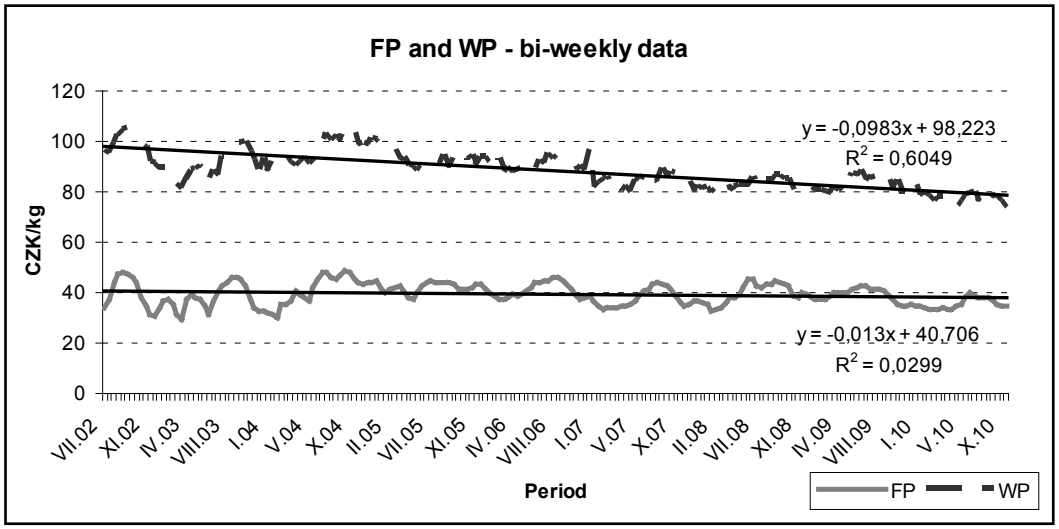
Graph 1: Time series of monthly data.



Source: own calculation

Graph 2: Time series of bi-weekly data.

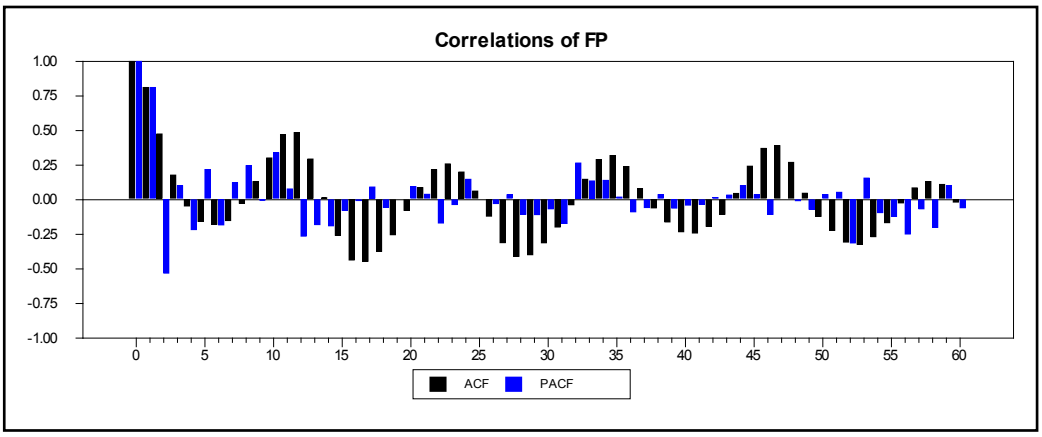
wholesale price in the case of monthly data were reached in October 2004. The minimum of farm-gate price in the case of bi-weekly data was reached in March 2004 and the minimum of wholesale price in April 2010. The maximum of farm-gate price was reached in September 2004, while the maximum of wholesale price was reached in October 2004. These results again show small differences in extreme values of the selected time series.

The time series of monthly data wholesale price show a slightly decreasing tendency in the analyzed period (see Graph 1). The long-term tendency of farm-gate price is almost stable. The long-term tendencies of the analyzed time series are described by linear trend functions.

The time series of bi-weekly data wholesale price also show a slightly decreasing tendency in the analyzed period (see Graph 2). In this case as well, the long-term tendency of farm-gate price is almost stable. The basic long-term tendencies of farm-gate as well as wholesale price are described by linear trend functions.

Next, the short-term behavior of the time series should be analyzed. Based on the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF), the seasonality of the time series can be detected. Graph 3 shows the ACF and PACF of farm-gate price in the case of monthly data, and Graph 4 shows the ACF and PACF of wholesale price for the same frequency. According to these functions, seasonal variation occurs in the time series of farm-gate price. The same frequency and amplitudes of the ACF confirm this statement. Nevertheless, no seasonal component in the time series of wholesale price was detected. The variation in this time series may contain a cyclical pattern which is not obvious in the analyzed period.

Graph 5 and Graph 6 contain the ACF and PACF for the time series of farm-gate price and wholesale price in the case of bi-weekly data. According to the



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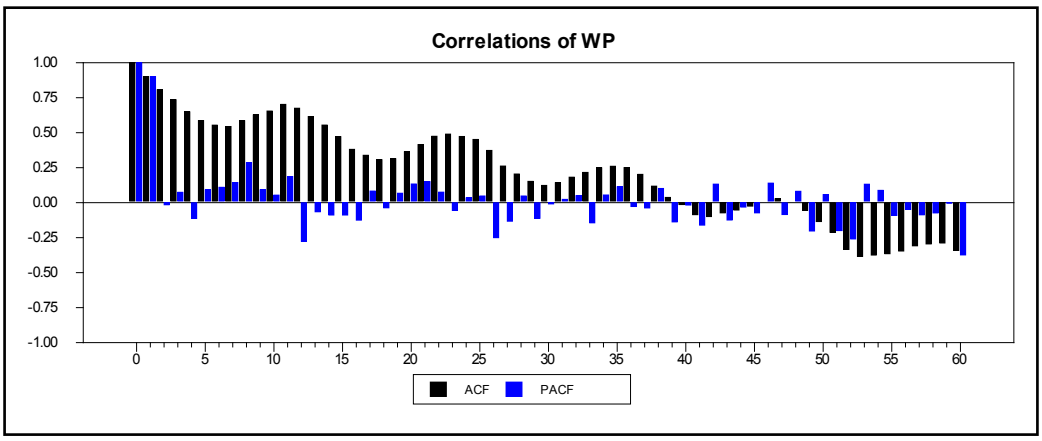
Graph 3: ACF, PACF of farm-gate price – monthly data.



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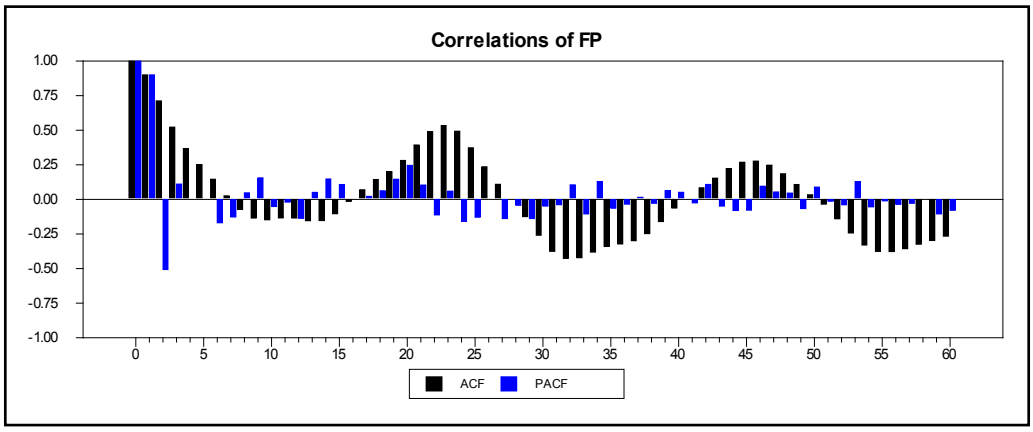
Graph 4: ACF, PACF of wholesale price – monthly data.



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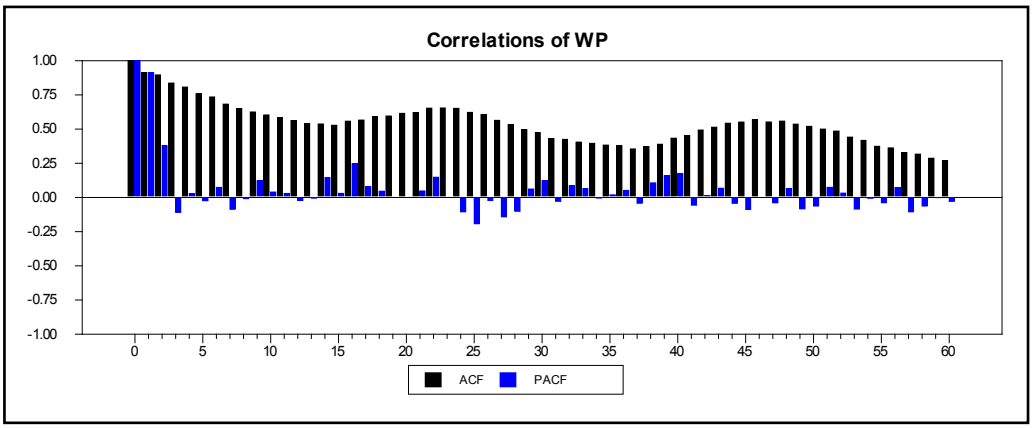
Graph 5: ACF, PACF of farm-gate price – bi-weekly data.



Source: own processing

Graph 6: ACF, PACF of wholesale price – bi-weekly data.

graph, the time series of farm-gate price contains a seasonal component. The ACF function again shows the repetitive frequency of the variation, and a pattern in the amplitudes of correlation coefficients. Similarly to the case of monthly data, the time series of wholesale price in the case of bi-weekly data does not contain a seasonal pattern. Moreover, in this case more differences are obvious compared to the time series of farm-gate price.

In conclusion, the long-term tendency of the selected time series shows a similar development in the analyzed period. In addition, the main statistical characteristics do not show significant differences. Nevertheless, small differences in the nature of the time series from a short-term perspective can be seen (i.e., differences in seasonality that can be described by individual time series). Only small differences were detected, and therefore one may conclude that in cases of both monthly and bi-weekly data, the nature of the time series is comparable.

2. Price transmission for time series of different frequency

Table 3 contains the results of the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) – criteria which suggest that each time series has significant lagged values. The results of these criteria are diverse. The maximal lag is then selected based partly on these suggestions and partly on knowledge of the pork market. The author decides to employ 4 lags as maximal significant lagged values in the case of monthly data and 10 lags in the case of bi-weekly data. Again, these results are very similar, and they show features similar to the inputs of consecutive price transmission analysis.

Table 4 and Table 5 contain the results of the Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP) – tests which verify whether the time series is stationary. Table 4 contains the results for the time series of monthly data, while Table 5 contains the results for the time series of bi-weekly

Monthly data			Bi-weekly data		
	AIC	SBC		AIC	SBC
FP	16	5	FP	16	7
WP	4	4	WP	10	1

Source: own calculation

Table 3: Significant lag of selected variables.

Variable	ADF test			PP test		
	A	B	C	A	B	C
FP	-0.3070	-3.3678	-3.4631	x	**-3.7899**	-3.9005
difFP	**-5.4179**	**-5.3794**	**-5.3865**	x	**-6.5689**	**-6.5562**
WP	-0.9023	-1.5230	-3.0938	x	-1.8216	-3.6897
difWP	**-5.4319**	**-5.4591**	**-5.5073**	x	**-10.3238**	**-10.3400**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant on significance level 5 %; bold = significant on significance level 1 %. Lag length for ADF and PP test = 4.

Source: own calculation

Table 4: Results of ADF and PP test – monthly data.

Variable	ADF test			PP test		
	A	B	C	A	B	C
FP	-0.1821	**-3.7932**	**-4.0561**	x	**-3.7773**	-3.9458
diffP	**-4.9593**	**-4.9419**	**-4.9555**	x	**-8.0235**	**-8.0238**
WP	-0.9303	-1.2910	-3.1979	x	-2.3754	**-5.1252**
difWP	**-4.8378**	**-4.8894**	**-4.8685**	x	**-22.0873**	**-22.0773**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant on significance level 5 %; bold = significant on significance level 1 %. Lag length for ADF and PP test = 10.

Source: own calculation

Table 5: Results of ADF and PP test – bi-weekly data.

data. The time series of monthly data are analyzed based on 4 significant lagged values, while the time series of bi-weekly data are based on 10 significant lags. Both tests (ADF as well as PP) show all selected time series to be non-stationary and integrated of the first order, i.e., I(1). This means that a long-term relationship can then be analyzed.

Table 6 and Table 7 contain the results of co-integration analysis. Table 6 contains the results for the time series of monthly data, while Table 7 contains the results for the time series of bi-weekly data. According to the Trace test and Eigenvalue, both relations contain one co-integrating vector. This means that a long-term relationship does exist between farm-gate price and wholesale price in both cases.

Table 8 contains the Beta transposed vector – the vector which shows the nature of the long-term relationship between farm-gate price and wholesale price, in cases of both monthly and bi-weekly data. The values included in this vector show slight differences; however, the price transmission in both cases shows very similar characteristics. The coefficient of price transmission elasticity reaches a value of 0.171 % in the case of monthly data and 0.224 % in the case of bi-weekly data. According to these values, the pork agri-food chain can be considered oligopsonic in both cases (the coefficient of price transmission elasticity is lower than 1). This means that the position of farmers is not as strong as the position of processors or retailers. Moreover, the relationship between farm-gate price and wholesale price is inelastic. Thus, producers of pork can be considered price takers, and the pork agri-food chain can be considered demand-driven.

II. Time series properties

The assumption of the influence of time series of different properties is examined in two periods – before the EU accession and after the EU accession. It can be assumed that the situation in the pork market differs in these two periods in connection with the general situation and current agricultural policy in the examined periods.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.193	21.067	20.062	15.408	0.006	0.008
1	1	0.005	0.513	0.508	3.841	0.474	0.476

Source: own calculation

Table 6: Results of cointegration analysis – monthly data.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.082	17.509	17.509	15.408	0.023	0.023
1	1	0.006	1.159	1.159	3.841	0.282	0.282

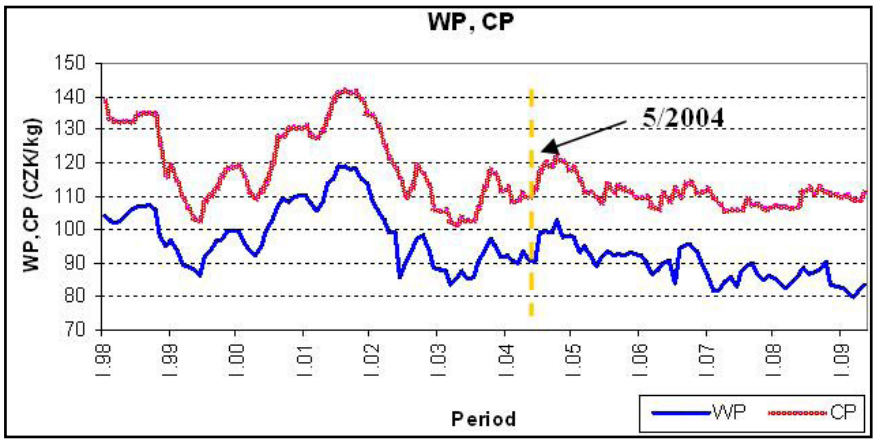
Source: own calculation

Table 7: Results of cointegration analysis – bi-weekly data.

Monthly data		Bi-weekly data	
FP	WP	FP	WP
1.000	-0.171	1.000	-0.224

Source: own calculation

Table 8: Nature of price transmission.



Source: own processing

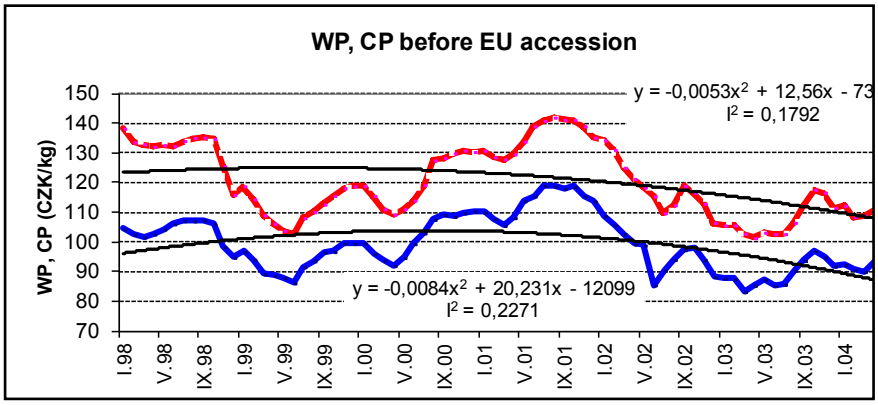
Graph 7: Wholesale price and consumer price of pork in the Czech Republic.

Price transmission between wholesale price and consumer price in the selected agri-food market is processed for the period from January 1998 to May 2009. In this period, seasonality was not proven. However, it is obvious that there was a structural break (the Czech Republic's accession to the European Union (EU)) which caused the wholesale price and consumer price time series to exhibit different behaviors (see Graph 7 and comments to Graph 8 and Graph 9), even though time series variability started to decrease in 2002. Therefore, price transmission is analyzed in two periods – before the EU accession and after the EU accession.

1. Description of selected time series

In the period before EU accession, the time series of the consumer price of pork almost copies the time series of the wholesale price of pork (see Graph 8). Similarly, in the period after EU accession, the time series of consumer price follows the time series of wholesale price (see Graph 9). The trend functions show the long-term tendency of each time series. However, in the period before EU accession the values of the index of determination are very low, whereas in the period after EU accession the values of indices of determination are sufficient.

Primary statistical characteristics such as the mean, standard error and coefficient of variation are shown in Table 9. These characteristics show that the relative variation in wholesale price and consumer price time series in the period before EU accession is almost the same, whereas in the period after EU accession the relative variation in



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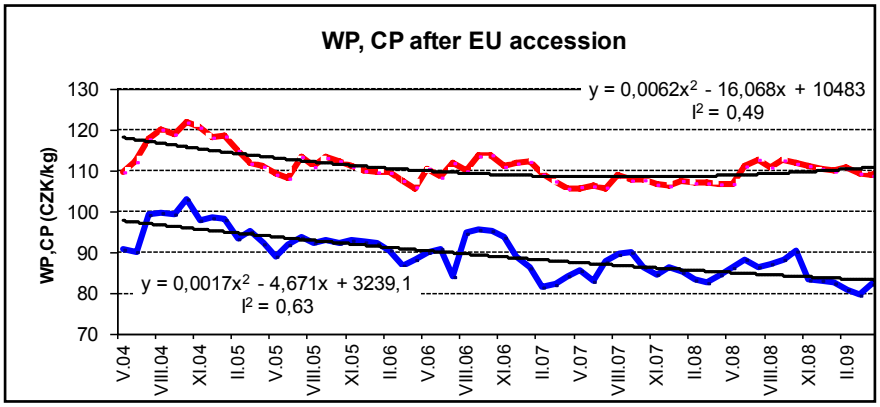
Graph 8: Wholesale price and consumer price of pork in the Czech Republic - period before EU accession.



Source: own processing

Graph 9: Wholesale price and consumer price of pork in the Czech Republic - period after EU accession.

	Period before EU accession				Period after EU accession		
	Mean (CZK/kg)	Std. deviation	Variation coefficient (%)		Mean (CZK/kg)	Std. deviation	Variation coefficient (%)
WP	99.40	9.3563	9.41	WP	89.32	5.4394	6.09
CP	120.46	11.9227	9.89	CP	110.86	3.8429	3.47

Source: own calculation

Table 9: Statistical characteristics of selected variables.

wholesale price is higher than the relative variation in consumer price.

2. Price transmission for different periods of time series

The Akaike Information Criterion (AIC) and Schwarz Beyesian Criteron (SBC) suggested that one period (month) is a significant lag length for both the wholesale price and consumer price of pork, in both the analyzed periods. Thus, one lag of both variables is employed to analyze their mutual relationship using the Vector Error Correction Model (VECM) or Vector Autoregressive Model (VAR), respectively.

Subsequently, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test found that both the wholesale price and consumer price of pork in the Czech Republic, in the period before as well as after EU accession, were non-stationary at a 1 % significance level, whereas their first differences were stationary (see Table 10 and Table 11). The time series of wholesale price and consumer price are non-stationary and integrated of order one, i.e., I(1). Therefore, VECM is employed for the following analysis.

Variable	ADF test			PP test		
	A	B	C	A	B	C
WP	-0.3781	-2.0351	-1.9459	x	-1.6713	-1.7537
difWP	**-4.9966**	**-4.9274**	**-4.9625**	x	**-6.5357**	**-6.5356**
CP	-0.5434	-2.2616	-2.1529	x	-1.8049	-1.7809
difCP	**-4.8566**	**-4.8231**	**-4.8514**	x	**-5.2973**	**-5.2971**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant at a significance level of 5 %; bold = significant at a significance level of 1 %. Lag length for ADF and PP test = 1.

Source: own calculation

Table 10: ADF, PP test - period before EU accession.

Variable	ADF test			PP test		
	A	B	C	A	B	C
WP	-0.4299	-4.2904	-1.8403	x	-2.0914	**-4.3141**
difWP	**-6.4946**	**-6.3956**	**-6.5171**	**x**	**-8.7629**	**-8.7848**
CP	-0.1683	-2.3919	-1.9751	x	-2.1822	-2.8103
difCP	**-5.6207**	**-5.5404**	**-5.5931**	**x**	**-8.5124**	**-8.5008**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant at a significance level of 5 %; bold = significant at a significance level of 1 %. Lag length for ADF and PP test = 1.

Source: own calculation

Table 11: ADF, PP test - period after EU accession.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.354	35.353	34.954	15.408	0.000	0.000
1	1	0.034	2.629	2.619	3.841	0.105	0.106

Source: own calculation

Table 12: Co-integration analysis - period before EU accession.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.258	21.193	20.890	15.408	0.005	0.006
1	1	0.053	3.275	3.259	3.841	0.070	0.071

Source: own calculation

Table 13: Co-integration analysis – period after EU accession.

Co-integration analysis has discovered one co-integrating vector in the analyzed relationships, thereby verifying and demonstrating the long-run relationship between the wholesale price and consumer price of pork in the analyzed period (see Table 12 and Table 13).

Table 14 contains selected parameters of the VECM in the period before EU accession. Alpha parameters show the speed at which equilibrium sets up - the higher the value, the faster the reaction of the variable. Transposed Beta shows the nature of the market structure. The value 0.781 expresses price transmission elasticity. This value shows that an imperfect market structure should be considered. Matrix PI describes the long-run relationship between wholesale price and consumer price. The results of additional tests (test of exclusion, stationarity, and weak exogeneity) and residual analysis are sufficient. Table 15 contains selected parameters of the VECM model describing the relationship between wholesale price and consumer price in the Czech Republic in the period after EU accession. Beta transposed describes the nature of the market structure; the value 1.413 displays the price transmission elasticity. Alpha parameters show how fast each variable reaches equilibrium - the higher the value, the faster the reaction. Matrix PI describes the long-run mutual

Beta (transposed)		Alpha	
logWP	logCP	logWP	0.076
1.000	-0.781	logCP	0.527

PI	logWP	logCP	t-values	
			logWP	logCP
logWP	0.076	-0.059	0.612	-0.612
logCP	0.527	-0.412	4.409	-4.409

Observations: 76; Degrees of freedom: 72

Source: own calculation

Table 14: VECM model - period before EU accession.

Beta (transposed)		Alpha	
logWP	logCP	logWP	-0.162
1.000	-1.413	logCP	0.230

PI	logWP	logCP	t-values	
			logWP	logCP
logWP	-0.162	0.228	-1.564	1.564
logCP	0.230	-0.324	3.485	-3.486

Observations: 76; Degrees of freedom: 72

Source: own calculation

Table 15: VECM model - period after EU accession..

relationship between selected variables. The results of additional tests (test of exclusion, stationarity, and weak exogeneity) and the results of residual analysis are sufficient.

As already mentioned, price transmission elasticity before EU accession reaches a value of 0.781, whereas price transmission after EU accession reaches a value of 1.413. Therefore, the market structure in the first period could be considered oligopsonic, while the market structure in the second period could be considered either oligopolistic, or both oligopolistic and oligopsonic (see the theoretical model specified, e.g., by Lloyd et al (2004) or Čechura, Šobrová (2008)). These days, both an oligopolistic and oligopsonic market structure is rather likely. Retailers can have oligopoly power with respect to consumers and oligopsonic power with respect to wholesalers. Moreover, the method of pork processing and distribution can also influence price transmission.

Conclusion

The aim of this paper was to verify whether the choice of time series can influence the results of price transmission analysis. First, the analysis was based on an examination of frequency and other properties of the time series; subsequently, the influence of the time series properties on the results of price transmission in the pork agri-food chain was examined.

First of all, the time series of the farm-gate price and wholesale price of pork were analyzed. The main features and statistical characteristics of these time series were examined. Then, a price transmission analysis was processed for both monthly data and bi-weekly data. Finally, the results of the analysis were compared and discussed. The results of the analysis showed slight differences in almost all cases. Several substantial differences were detected as well; however, these factors are not so important and should not significantly influence the results of the price transmission. Thus, the assumption that the choice of time series frequency influences the results of the price transmission analysis was not confirmed. However, researchers should be careful, and choose the time series for empirical analysis cautiously. General conclusions about the nature of the time series and price transmission seem to be the same; however, detailed results might be dissimilar. For instance, consider the case of price transmission elasticity being an important aspect of

price transmission: the level of price transmission elasticity in the case of monthly data differs from price transmission elasticity in the case of bi-weekly data. However, results concerning the market structure remain the same. In conclusion, the differences in general price transmission results are not significant, while some detailed results could be marked as significant.

In the second part, the time series of wholesale price and consumer price, as well as their transmission, were examined in two periods: the period before EU accession and the period after EU accession. The analysis showed that the analyzed time series exhibited different behaviors and properties within these periods, and therefore one could conclude that the selection of time series period can significantly influence the results of price transmission. This result was also confirmed based on a subsequent analysis of price transmission in the analyzed periods. The price transmission analysis found a difference in the nature of the price transmission. Structural breaks and other factors which might cause changes in the nature of the time series could be crucial for price transmission analysis. Thus, when price transmission is analyzed, the properties of the time series should be examined properly.

In conclusion, the frequency of the time series should not be a critical factor in the results of price transmission; however, the choice of time series length can significantly influence the results of price transmission.

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