MAGYAR TUDOMÁNYOS AKADÉMIA
Közgazdaság- és Regionális Tudományi Kutatóközpont

KRTK
CERS-HAS

Research Centre for Economic and Regional Studies
HUNGARIAN ACADEMY OF SCIENCES

MŰHELYTANULMÁNYOK DISCUSSION PAPERS

MT-DP – 2012/12

Does Farm and Processing Industry Structure Matter for Price Transmission? Some Evidence From Transition Countries: A Comparison of Dairy Sectors in Hungary and Poland

ZOLTÁN BAKUCS - JAN FAŁKOWSKI - IMRE FERTŐ

INSTITUTE OF ECONOMICS, RESEARCH CENTRE FOR ECONOMIC AND REGIONAL STUDIES,
HUNGARIAN ACADEMY OF SCIENCES BUDAPEST, 2012

Discussion papers
MT-DP – 2012/12

Institute of Economics, Research Centre for Economic and Regional Studies,
Hungarian Academy of Sciences

Does Farm and Processing Industry Structure Matter for Price Transmission? Some Evidence From Transition Countries: A Comparison of Dairy Sectors in Hungary and Poland

Authors:

Zoltán Bakucs
research fellow
Institute of Economics, Research Center for Economic and Regional Studies, Hungarian Academy of Sciences
email: bakucs@econ.core.hu

Jan Fałkowski
Faculty of Economic Sciences
University of Warsaw, Poland
email: jfalkowski@wne.uw.edu.pl

Imre Fertő
research advisor
Institute of Economics, Research Center for Economic and Regional Studies, Hungarian Academy of Sciences
Corvinus University of Budapest
email: ferto@econ.core.hu

March 2012

ISBN 978-615-5243-05-9
ISSN 1785 377X

Does Farm and Processing Industry Structure Matter or Price Transmission? Some Evidence From Transition Countries: A Comparison of Dairy Sectors in Hungary and Poland

Zoltán Bakucs - Jan Fałkowski - Imre Fertő

Abstract

Rapid and thorough changes have recently taken place in dairy supply chain in the whole Central and Eastern Europe. Growing concerns have been expressed that these changes may negatively affect farmers' relative position towards downstream industry, due to market power exercised by the latter. In response to this, the present paper aims to investigate the price transmission mechanism in two countries from the region, namely Poland and Hungary and contrast the results with dairy market organisations specific for these countries. Using cointegrated vector autoregression and controlling for potential structural breaks, it is shown that Polish milk prices, as opposed to Hungarian ones, are characterised by short- and long-term asymmetries. We discuss a number of potential explanations supporting the empirical results. We consider, among others, differences between the dairy chain structures and the role of FDI.

Keywords: price transmission, dairy sector, Hungary, Poland

JEL classification: Q13, D12, D4

Befolyásolja-e a mezőgazdasági és feldolgozóipari üzemstruktúra az ártranszmissziót?
A magyar és lengyel tejtermelő ágazatok összehasonlítása

Bakucs Zoltán - Jan Fałkowski - Fertő Imre

Összefoglaló

Az elmúlt években gyors, ugyanakkor átfogó változások rázták meg a közép-kelet-európai országok tejszektorait. Az ágazat egyes szereplői úgy vélik, hogy ezek a változások negatívan befolyásolják a tejtermelők feldolgozó iparhoz viszonyított relatív pozícióját. Ezt figyelembe véve tanulmányunk két térségbeli gazdaság, Magyarország és Lengyelország tejtermelő ágazatában vizsgálja az ártranszmissziót, és magyarázza az eredményeket a két ország eltérő tejpiaci szerkezetének tükrében. Strukturális töréseket is figyelembe vevő kointegrált vektor autoregresszív modell alkalmazásával megállapítottuk, hogy a lengyel tej ártranszmissziója, ellentétben a magyar piacon megfigyeltekkel, hosszú és rövi távon is aszimmetrikus. Az empirikus eredményeket – egyebek mellett – a két ország eltérő piacszerkezetével, a külföldi közvetlen befektetések szerepével magyarázzuk.

Tárgyszavak: ártranszmisszió, tejtermelő ágazat, Magyarország, Lengyelország

JEL kódok: Q13, D12, D4

I. INTRODUCTION

Rapid and thorough changes have recently taken place in dairy supply chain in the whole Central and Eastern Europe (see e.g. Swinnen et al., 2001; EAAP, 2008). Following the global trends, local dairy sectors have experienced tremendous and rapid changes as far as the organisation of the milk supply chain is concerned. These changes have been impressed both on the marketing and production practices as well as relations between downstream and upstream sectors. Growing concerns have been expressed that these changes may have negatively affected farmers' relative position towards downstream industry, due to market power exercised by the latter (see e.g. Csaki et al., 2008 and citations therein). At the same time it has often been argued that price increases at the final stage of the dairy supply chain are not fully transmitted upwards. This statement has found support in number of studies for Western countries. Gohin and Guyomard (2000), using a structural model, strongly rejected the hypothesis that French food retail firms behave competitively and concluded that more than 20% of the wholesale-to retail price margins for dairy products can be attributed to oligopoly-oligopsony distortions. Imperfect price transmission in dairy sector was also found for the UK, Germany and Denmark (London Economics, 2003). Similar conclusions could be drawn for the US (Kinnucan and Forker, 1987; Lass, 2005; Capps and Sherwell, 2007) and Brazil (Aguiar and Santana, 2002). On the other hand, Serra and Goodwin (2003) found no evidence of price transmission asymmetries in the Spanish dairy and perishable products sectors.

Quite surprisingly, in Central and Eastern Europe in general, and for dairy sectors in particular, the discussion focusing on the mechanism of price transmission often relies on anecdotal accounts and only a few studies tried to find empirical evidence supporting these views (examples include: Bakucs and Ferto, 2005; 2006; Bojnec and Günther, 2005; Seremak-Bulge, 2005; Brummer et al., 2006). This relative lack of studies is the more striking since changes that are likely to affect the distribution of vertical rents are especially prone to occur in transition context. Therefore, this paper aims to investigate the price transmission mechanism in dairy sectors of two countries in the region, Poland and Hungary. By comparing situation in these two countries, it attempts to provide the additional insights on how various aspects of institutional environment within marketing chain may have affected the vertical linkages characterising food markets in transition. To our knowledge, the present paper is the first to divert from a single country focus and to look at these issues in a two-transition-countries setting.

The choice of Poland and Hungary for the analysis is motivated by a number of reasons. First, although both countries suffered under the well-known shortcomings of communist economic and social policy, each of them was left with different legacy. In Hungary dual production structure based on agricultural enterprises and individual farms was predominant, with the latter cultivating around 60% of land (Swinnen and Vranken, 2006). In Poland, on the other hand, family farms' share in agricultural land accounts for almost 90% (GUS, 2005). In this context, comparing Poland with Hungary provides an opportunity to examine whether this difference in the organisational form of agricultural holdings has had any impact on the vertical relations within the agrifood chain. Second, in order to meet the EU quality requirements, in both countries outstanding investments took place in the dairy industry. Here again there are considerable differences between Hungary and Poland, mostly with regard to the role of foreign direct investments (FDI). Considering that FDI has been identified as one of the most notable factors stimulating changes and innovations in the global agrifood sector (Dries and Swinnen, 2004; Swinnen et al., 2006), comparing the price transmission mechanism in these two countries may provide some insights on the impact of ownership on power relations within the supply chain. Third, in both countries the dairy sector is one of the most successful examples of post-communist restructuring. Finally, in both countries the milk sector is of a major importance within agriculture and food industry.

The main purpose of the analysis is to investigate the degree of price transmission between price changes occurring at the farm level and price changes at the retail level. This is of importance for at least two reasons. First, it provides insights on the distribution of vertical rents (see, for instance, McCorriston and Sheldon, 2007). As such, it helps to identify to which extent consumers benefit from productivity increases in agricultural production and processing or other price-reducing mechanisms. Second, it may provide information about the extent and the significance of restraints to competition and their impact on price margins (Holloway, 1991; McCorriston et al. 1998; 2001). It should be noted however, that several contributions to the theoretical literature demonstrated that the presence of oligopoly and/or oligopsony power does not necessarily imply imperfect price transmission, and thus other factors should also be considered, among others, the cost function of the industry (McCorriston et al., 2001) or functional forms of retail demand and farm input supply (Weldegebriel, 2004)[1].

The remainder of the paper is structured as follows. The second part provides basic information on dairy sectors in Hungary in Poland which serve as a background for further analysis. The third part presents the methodology. The fourth part presents the data and

[1] Azzam (1999) shows that asymmetry may also occur in a competitive environment due to intertemporal optimizing behavior among spatially competitive retailers.

results. The fifth part provides the discussion and interpretation of the findings whereas the sixth one concludes.

II. DAIRY SECTORS IN HUNGARY AND POLAND – BASIC FACTS AND FIGURES

After overthrowing communism and entering the transition period, restructuring process in the dairy sectors in Poland and Hungary shared number of common characteristics. One of the most notable phenomena was an exceptional decrease of the number of dairy farms. In the 1995-2007 period, the number of dairy farms in Poland decreased by 50% to reach roughly 650 thousands. In Hungary this decrease was even higher and amounted to 59% leaving approximately 7500 dairy farms in the sector. Second, in both countries a continuous decrease of the number of dairy cows could have been observed since the beginning of the transition period. In Poland, the number of dairy cows decreased from almost 5 million in 1989 to 2.7 million in 2007 whereas in Hungary it dropped from almost 500 thousands in 1992 to 323 thousands in 2007. Third, in both countries the processing sector consolidated in the transition period. In Poland during the past 10 years the number of dairy processors has decreased by 30 per cent to about 232 in 2007. In Hungary this tendency was stronger resulting in number of companies decreasing from roughly 170 in 1996 to 58 in 2007. As a consequence, there is quite substantial difference between these two countries with regard to the concentration ratio. In 2006 the four largest processors in Poland were estimated to process around 22% of raw milk production whereas in Hungary C5 index already in 2001 amounted to roughly 60%, remaining around this level ever since.

Furthermore, as far as the FDIs are concerned, it has been estimated that in Poland in 2004 domestic dairy cooperatives had around 80 per cent (70 per cent) of market share in terms of milk purchases (sales value) (Seremak-Bulge, 2005). Foreign companies' market shares on the other hand, have been estimated to be less than 10 per cent (Dries and Noev, 2006). Contrary, to Poland, in the Hungarian dairy sector, foreign direct investments' share in owners' equity exceeded 80 per cent already in 2000. The fact that processing sector in Poland is dominated by farmers' cooperatives should also be seen as a distinctive feature. Last but not least, it should be noted that these two countries differ significantly in terms of the size of the sector. Annual (2007) milk production in Poland is roughly 11.6 billion litres (approximately 300 litres *per capita*), whereas Hungarian production amounts to roughly 1.8 billion litres (around 180 litres *per capita*).

Other notable differences between Polish and Hungarian dairy sectors can be observed with respect to dairy farm structure and the role of foreign direct investments. In Poland, milk is predominantly produced by family farms which own 95% of dairy cows. In 2005 the average herd size amounted to almost 4 cows and more than 50% of holdings had less than 10 cows (Wilkin et al., 2006). In Hungary, on the other hand, milk is predominantly produced by agricultural enterprises. In 2005 their share in number of dairy cows accounted for 67% whereas family farms' share was 33%. The average herd size in agricultural enterprises was 295 and on individual farms 6.2.

Finally, with regard to the retail sector, in Poland market concentration continues to be low compared with the other European countries. The five largest retail companies in Poland captured in 2006 around one-fifth of the national modern grocery distribution, while in countries like Germany and France this share exceeds 80 per cent. However, recently, the consolidation process of large retail chains has accelerated (Wilkin et al., 2006). In Hungary at the beginning of the transition period, due to several factors (privatisation, the emergence of multinational retail chains, high number of small private entrepreneurs) the number of retail units rocketed from 25,000 in 1990 to 60,000 by the end of the decade. This trend was reversed after 2000 with a fast concentration process (by the end of 2007 the number of retail units fell back to 45,000), the main actors of the retail level becoming the super and hypermarkets. Now, the five largest retail companies account for two-thirds of grocery sales, whilst the ten largest for 90%, thus Hungary has a relatively high retail concentration amongst the New EU Member States, being close to the EU average.

In sum, although both countries share some common characteristics observed in most transition countries, there are number of substantial differences between them. The following sections present how these similarities/differences could be translated into the understanding of the price transmission mechanism in Poland and Hungary.

III. METHODOLOGY

In order to analyse price transmission mechanism we follow modern time series methodology. With the development of cointegration techniques, attempts were made to test asymmetry in a cointegration framework. Von Cramon-Taubadel (1998) demonstrated that the Wolffram-Houck type specifications are fundamentally inconsistent with cointegration and proposed an error correction model of the form:

$$\Delta RP_t = \alpha + \sum_{j=1}^{K} (\beta_j^+ D^+ \Delta FP_{t-j+1}) + \sum_{j=1}^{L} (\beta_j^- D^- \Delta FP_{t-j+1}) + \varphi^+ ECT^+_{t-1} + \varphi^- ECT^-_{t-1} + \sum_{j=1}^{P} \Delta RP_{t-j} + \gamma_t \quad (1)$$

The error correction term, (ECT_t), is in fact the residual of the long-run (cointegration) relationship: $ECT_{t-1} = \mu_{t-1} = RP_{t-1} - \lambda_o - \lambda_1 FP_{t-1}$; where λ_o and λ_1 are coefficients to be estimated. The error correction term is than segmented into positive and negative phases (ECT^+_{t-1} and ECT^-_{t-1}), such that: $ECT_{t-1} = ECT^+_{t-1} + ECT^-_{t-1}$.

In practice, we implement our estimation strategy in four steps. We start by testing for unit roots, followed by cointegration analysis. The third step is the estimation of Vector Error Correction (VEC) models. Finally, we test for price transmission asymmetry and the direction of causality. While conducting our analysis, we control for potential structural breaks.

There are large numbers of unit root tests[2] available in the literature (see Maddala and Kim, 1998 for a comprehensive review). In this paper we employ the commonly used Augmented Dickey-Fuller unit root tests[3]. In order to check whether our price series are cointegrated[4], we apply the standard Johansen multivariate procedure (Johansen, 1988) as well as Gregory and Hansen test (Gregory and Hansen, 1996). The latter one allows to test for the null hypothesis of no-cointegration against the alternative of cointegration with structural breaks.

Thus we are able to control for potential shifters occurring in our data. Depending on the deterministic components of the test equation, 3 models are considered: a model with a change in the intercept, model with a change in the intercept and a time trend, and finally, a model allowing for a structural change both in the intercept and the slope.

Using a VECM representation as in (1), both the short-run and the long-run symmetry hypothesis can be tested, using standard tests. The speed of adjustment parameters from factor loading matrix (α), indicate the weakly exogenous prices and ultimately the direction of long run causality. Following Boswijk and Urbain (1997) we also test for the short-run exogeneity by estimating the marginal model (2) and performing a variable addition test of the fitted residuals $\hat{v}_t$ from (2) into the statistical model, (1):

$$\Delta PP_t = \psi_0 + \psi_1(L)\,\Delta PR_{t-1} + \psi_2(L)\,\Delta PP_{t-1} + v_t \qquad (2)$$

Long-run exogeneity is tested by the significance of the error correction terms in the equations (1), and (2).

[2] Consider the first order autoregressive process, AR(1):
$y_t = \rho y_{t-1} + e_t$, t =...,-1,0,1,2,..., where e_t is white noise.
The process is considered stationary if $|\rho| < 1$, thus testing for stationarity is equivalent with testing for unit roots ($\rho = 1$). Rewriting to obtain:
$\Delta y_t = \delta y_{t-1} + e_t$ where $\delta = 1 - \rho$, the test becomes:
$H_0 : \delta = 0$ against the alternative $H_1 : \delta < 0$.

[3] For robustness we also employed Kwiatkowski et al. (1992) unit root test, which, opposed to ADF, has stationarity under the null hypothesis. The results, however, remained unaffected.

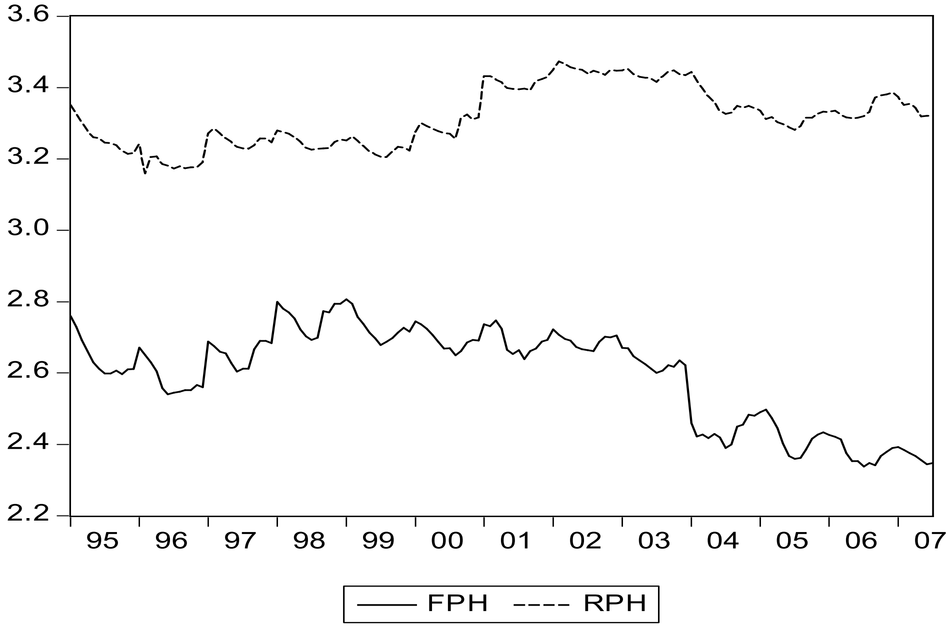
[4] Two or more non-stationary variables are cointegrated if there exists one or more linear combinations of the variables that are stationary.

IV. EMPIRICAL ANALYSIS

The data used in the analysis were provided by the Hungarian and Polish Central Statistical Offices. Logs of Hungarian and Polish monthly milk retail (RPH and RPP respectively) and producer prices (FPH and FPP respectively) between January 1995 and July 2007, totalling 151 observations, were used for the empirical analysis. The price series are presented in Figures 1 and 2.

Fig. 1.

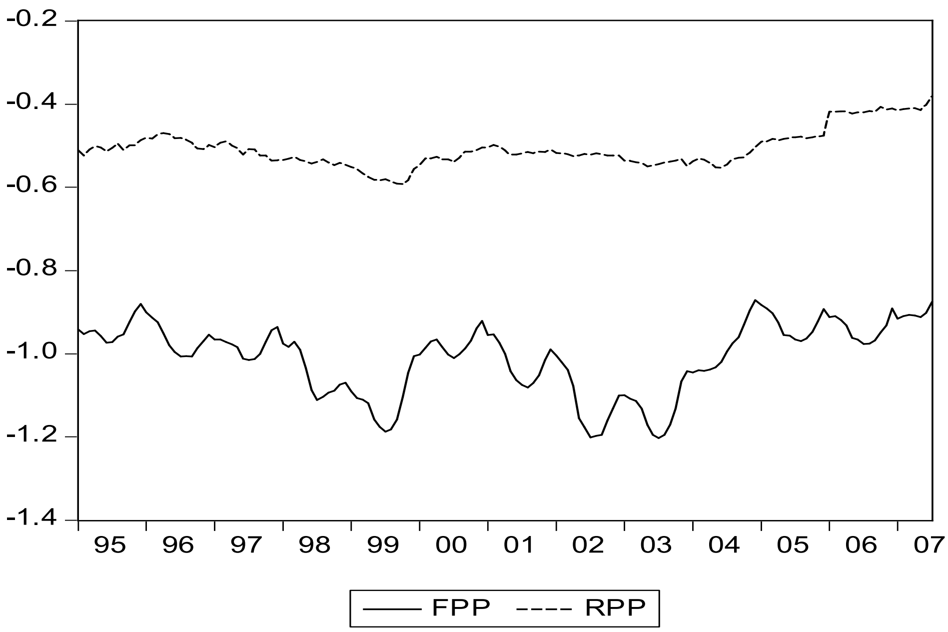
The log of deflated milk producer and retail prices in Hungary



Source: Own calculations, data from the Hungarian Central Statistical Agency

Fig. 2.

The log of deflated milk producer and retail prices in Poland



Source: Own calculations, data from Polish Central Statistical Office

First, we perform unit root tests to evaluate the stationarity properties of the data. Results are presented in table 1. The tests indicate that all price series contain a unit root with constant and/or trend. The unit root null hypothesis is rejected for the first differences of all price series. Therefore we conclude that all four series are integrated of order one in levels and stationary in first differences.

Table 1.

Augmented Dickey - Fuller unit root tests

	Levels		First differences	
	Lag length	ADF stat	Lag length	ADF stat
		POLAND		
FPP	14	-1.56	13	-2.88***
RPP	0	-0.29	0	-10.71***
		HUNGARY		
FPH	12	-2.06	11	-2.39**
RPH	13	-2.43	11	-2.37**

Note: Own calculations. ** significant at 5%, *** significant at 1%. FPH trend and constant included; FPP constant included; RPH constant and trend included, RPP constant and trend; the inclusion of seasonal dummies does not change test results. Lag length was selected by Akaike information criteria.

Since all data is non-stationary, in order to detect whether there is any long-run relationship between the investigated price series, we proceed to cointegration testing. Johansen cointegration test results for each country are presented in table 2.

Table 2.

Johansen cointegration trace test statistics

	Rank	Test statistics [p-value]
POLAND (lag length = 13)	0	29.97[0.000]***
	1	2.28[0.722]
HUNGARY (lag length = 13)	0	16.15[0.170]
	1	4.56[0.346]
HUNGARY (lag length = 13)	0	25.18[0.029]**
structural break=2000_11	1	8.06[0.28]

Note: Own calculations. ** significant at 5%, *** significant at 1%. A constant restricted to the cointegration space was included in the VECM. Lag length was selected by Akaike information criteria.

According to expectations based on the visual inspection of the figure 2, test results confirm that Polish farm and retail prices move together and indicate one cointegration vector. For Hungary, the null hypothesis of no cointegration between farm gate and retail prices of milk is only rejected if a structural break occurring in November 2000 is included in the long-run relationship. The timing of the structural break affecting the long-run relationship between Hungarian farm gate and retail prices of milk was detected using the Gregory and Hansen (1996) procedure. This procedure recursively tests for possible structural breaks through the middle 85% of the sample choosing the one least favourable for the rejection of the unit root null hypothesis against the stationary relationship with a structural break alternative[5]. Figure 3 presents the recursively estimated ADF statistics reaching a minimum at November 2000[6]. This result well corresponds to figure 1 indicating that farm and retail prices in Hungary seem to slightly diverge over time, starting from the year 2000. This seems to be due to a number of factors, most importantly to the fact that the previously rapid concentration process slowed down (see figure 4) and the market shares of the major players stabilised after the bankruptcy of a large processor, MiZo. All this provided favourable conditions for an increase in constant

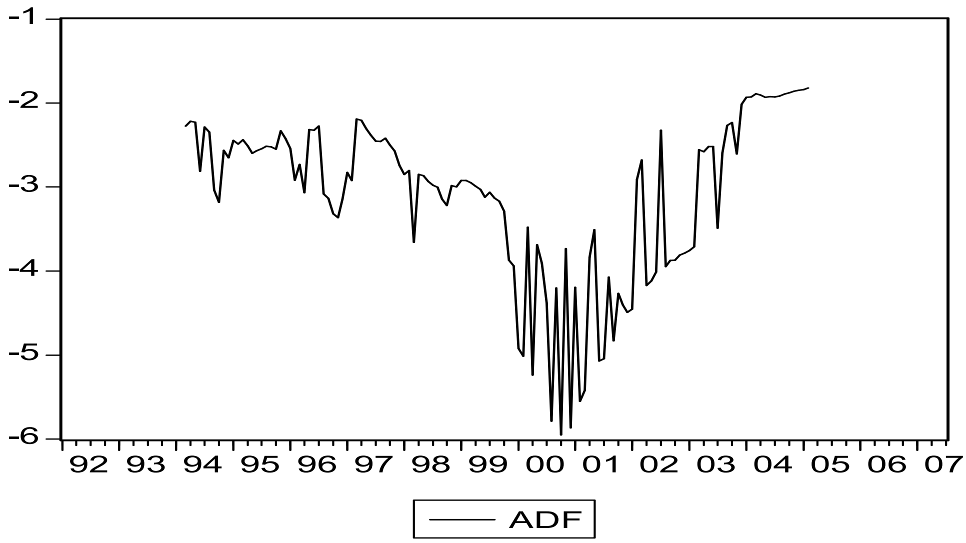
[5] For each possible breakpoint, the ADF statistics corresponding to the residuals of models are computed, then the smallest value is chosen as the test statistic (being the most favourable for the rejection of the null). Critical values are non-standard, and are tabulated in Gregory and Hansen (1996).

[6] The minimum ADF statistic corresponding to a breakpoint in November 2000 is – 5.951, significant at 1%, thus rejecting the no cointegration null hypothesis and reinforcing Johansen test results with included structural break dummy.

absolute margin between Hungarian farm and retail prices[7]. Since in this paper we use farm and retail level data, and have no information about processor level prices, it is unclear whether processors or retailers increased their bargaining power through the increased marketing margin.

Fig. 3.

Recursively estimated Gregory - Hansen AFD statistics



Source: Own calculations, data from the Hungarian Central Statistical Agency

Table 3 presents the estimated long-run price relationships in Poland and Hungary. Estimates have the correct sign and confirm a growth in the Hungarian price spread after the regime change in November 2000.

Table 3.

Cointegration vectors (normalised on retail prices)

	POLAND	HUNGARY
Retail price	1	1
Farm price	-0.674[7.147]***	-0.303[5.352]***
Shifter	-	-0.160[10.53]***
Constant	-0.170[1.756]*	-2.443[16.102]***

Note: Own calculations. * significant at 10%, *** significant at 1%. t-statistics in brackets. Lag length was selected by Akaike information criteria.

[7] To illustrate this phenomena, one may recall that, according to GFK Hungary Market Research Institute's ConsumerScan database, although quantity of milk and milk product consumption hardly increased during 2000, the value of consumed amount grew quite substantially (e.g. milk quantity increase: 0%, value +16%, cheese quantity: +1 %, value: +18%, sour cream quantity: -7%, value +10%).

The factor loading matrix of the VEC model is reported in table 4. The figures presented are the speed adjustment parameters, responsible for shifting the system back to its long-run equilibrium path should a short-run shock occur. These parameters also indicate long-run weak exogeneity and, in turn, long-run Granger causality. The parameters have the expected sign. In case of Poland they are not significant in the retail price equation. For Hungary, they are insignificant in the farm price equation. This finding leads to our first interesting result, namely that in the long-run, in Poland retail prices cause farm prices, whilst in Hungary causality runs from farm gate to retail prices[8].

Table 4.

Factor loading matrices

	POLAND	HUNGARY
Retail price	-0.007[0.304]	-0.218[5.338]***
Farm price	0.196[5.464]***	-0.073[1.188]

Note: Own calculations. * significant at 10%, ** significant at 5%, *** significant at 1%. t-statistics in brackets.

Valid inference in this respect however, requires a variable to be weakly exogenous both in the long as well as in the short-run. Since factor loading matrices indicate only the long run exogeneity, following Boswijk and Urbain (1997) short run exogeneity with respect to retail price in Poland and farm price in Hungary is tested using a variable addition test of the fitted residuals from the marginal equation (2) into the structural equation (1). The results of the relevant tests are reported in table 5.

Table 5.

Boswijk and Urbain (1997) test for short run weak exogeneity (variable deletion test)

	F-stat (1, 111)	p-val
RPP weakly exogenous	0.0071	0.9328
FPH weakly exogenous	0.025	0.8744

Note: Own calculations.

The presented figures fully support previous conclusions. More specifically, short-run exogeneity results are consistent with long-run ones, emphasising that in both long and short-run Polish retail prices cause farm gate prices, whilst in Hungary farm prices cause retail prices.

[8] Since the presence of cointegration relation implies Granger causality in at least one direction (Lutkepohl and Kratzig, 2004) these results are consistent with expectations that could be based on the cointegration analysis.

On the basis of these results we proceed to investigate potential imperfections in price transmission mechanism. More specifically, we test whether price increases are transmitted along the food supply chain differently than price decreases. To better understand the price transmission phenomena, we investigate the presence of both short and long-run asymmetries. We estimate the segmented VECM model (1), than employ sequential Wald and t-tests to reduce the overparameterised VECM to a more parsimonious model[9]. Long and short-run asymmetry test results are presented in table 6.

Table 6.

Testing the long-run and short-run asymmetry most parsimonious models

	Long run H_0: ECT^{+}=ECT^{-}	Short run H_0: $\sum\Delta P^{+}=\sum\Delta P^{-}$
POLAND	F(1, 108) = 6.30 [0.013]	F(1, 108) = 19.38 [0.000]
HUNGARY	F(1, 132) = 0.90 [0.345]	F(1, 132) = 0.63 [0.429]

Note: Own calculations. p-values in brackets

It follows from table 6, that first, vertical price transmission in the Polish dairy sector is asymmetric in both short and long-run. Second, contrary to the Polish case, in Hungary the null hypothesis of symmetrical price transmission cannot be rejected for either short or long-run. Thus, our second interesting finding is the difference in the vertical transmission mechanism of the two countries considered.

Before moving on to the discussion on the results, some diagnostics of the segmented VECM are presented in table 7. The estimated models for both countries pass the LM-tests for residual autocorrelation at the 5% significance level. The null of homoscedasticity cannot be rejected either. The Hungarian model however does not pass the Ramsey test for omitted variables. After including a single impulse dummy (January 2006) in the Polish equation, residuals can be rendered normal. Residuals of the Hungarian model on the other hand, are non-normal, which implies that the test results must be interpreted with care, although asymptotic results do hold for a wider class of distributions (von Cramon-Taubadel, 1998).

[9] Interpretation of VECM coefficient estimates are not particularly important for the goals of this paper, therefore due to space limitations they are not presented, however estimates are available from authors upon request.

Table 7.

Diagnostics for the OLS asymmetric most parsimoniuos model

	Ramsey test	Breusch-Godfrey test	Heteroscedasticity test
POLAND	F(3,105)=1.23 [0.301]	chi2(10)=13.89 [0.177]	chi2(1)=1.03 [0.309]
HUNGARY	F(3, 128)=3.90 [0.01]	chi2(3)=1.893 [0.594]	robust S.E.

Note: Own calculations. p-values in brackets; LM-test the most significant result for up to 12^{th} lag is presented; ARCH test were insignificant regardless of number of lags chosen.

V. DISCUSSION AND INTERPRETATION

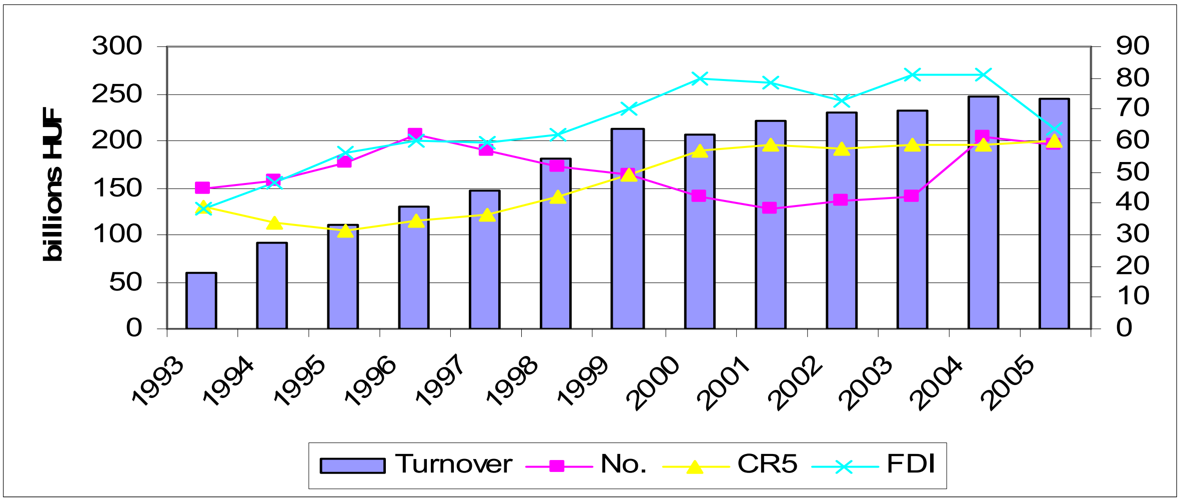
Returning to the results presented in table 6, the striking difference between the investigated countries as regards vertical price transmission might look quite surprising at first sight. However, it becomes more understandable once differences between Poland and Hungary in terms of the development path of their dairy sectors during transition are assessed. There are four issues of special importance here. First, there are notable differences in the national dairy farm structures. In Poland dairy production is made almost exclusively on individual farms and excessive herd fragmentation is among the most important problems. In Hungary, on the other hand, although there are still large numbers of private dairy farms, dairy production is dominated by large scale agricultural enterprises. A small number, but powerful Producer Organisations also emerged, the biggest in dairy sector, 'Alföldi Tej', contributes 30% to the national raw milk production (Szabó and Popovics, 2008). This obviously must have had its effect on the bargaining power of local farm sectors leaving Hungarian milk producers in relatively more favourable conditions. As a result, compared to situation in Poland, when the marketing margin is squeezed the effect on farm prices is not necessarily stronger than in the situation of increasing margin. This difference in farm structure also helps to explain the differences in direction of causality between farm and retail prices that could be observed in both countries (Tables 4 & 5).

Second, the results should be seen from the angle of relative importance of FDI's in the sector. As presented in section 2, Hungarian processing industry is dominated by foreign owned companies whereas in Poland most processing is still in the hands of domestic companies. As discussed by several studies (see, for instance, Swinnen, 2006; or Swinnen et al., 2006, and citations therein), foreign direct investments have been identified as one of the most notable factors stimulating changes and innovations in the world agri-food sector's. Among others, foreign owned companies initiated assistance programmes to facilitate adjustments at farm level (Jansik, 2002; Pieniadz and Hockmann, 2006). Moreover, they introduced innovative contract schemes (Gow and Swinnen, 1998; Swinnen et al., 2006; White and Gorton, 2006). In this context, one may risk the hypothesis that, especially in earlier phases of transition, modernisation of supply network in Hungary proceeded faster than in Poland. This also might have contributed to the relatively stronger bargaining power of Hungarian dairy farms as compared to the Polish ones.

Third, the interpretation of the results obtained needs to take into account substantial differences between Poland and Hungary as regards market structure at the processing level. As already mentioned in section 2, the concentration ratio in dairy industry in Hungary (figure 4) is much larger than that observed in Poland[10].

Fig 4.

Turnover, number of companies, industry concentration and FDI in Hungary (share in owners equity)



Note: Own calculations, data from Agricultural Economics Research Institute.

One might not exclude therefore, that in the former case this is the processing sector that dictates the terms in the supply chain and is able to benefit from the largest share of vertical rents. Consequently we may observe symmetric price transmission between farm and retail sectors where in fact asymmetries may occur in farm-processing and processing-retailer relationships. Unfortunately our data limitations do not allow verifying this hypothesis. However, Hockmann and Vőneki (2008) using a structural equation model, find that oligopsony power is significant but at a rather low level in Hungarian milk processing. They also argue that the absence of market power can be explained by the fact that farmers have alternative choices to sell their products. As far as the Polish case is concerned, it should be

[10] It should be noted though that in last years in neither country dairy sector has been punished by antitrust authorities for uncompetitive practices.

noted that processing sector in Poland is dominated by dairy cooperatives. This may weaken relative position of processors towards the retail sector and thus asymmetric farm-retail price transmission is in line with expectations. Moreover, as found by Pietrzak (2007), Polish processing sector is characterised by increasing returns to scale which may additionally suggest that farm-retail rather than farm-processing price transmission asymmetries should be expected (McCorriston, et al. 2001).

Fourth, it should be noted that Poland is several times the size of Hungary. This has implications on spatial concentration level of downstream industry, since local monopsonies are more likely to occur in Poland. In addition, Azzam (1999) theoretically shows that asymmetry may also be due to concave spatial demand, partly explaining the asymmetrical transmission in Poland despite the low industry concentration compared to Hungary. Finally, there is empirical evidence that regional dairy prices in Hungary are spatially integrated (Bakucs and Fertő, 2008), supporting the symmetrical transmission result in Hungary.

VI. CONCLUSIONS

In response to relative lack of studies analysing the process of forming agricultural prices in Central and Eastern Europe, the present paper investigates the mechanism of price transmission in dairy sectors in Poland and Hungary. These two countries share a number of similarities due to common history, but also notable differences between them could be observed in some respects. This provides a very interesting field of research giving the opportunity to analyse several aspects of the transition process. As far as we know, our paper is first to analyse the price transmission mechanism in a transition context where more than one country is under scrutiny.

Following recent developments in time series methodology, we couch our analysis in the vector error correction model framework allowing for potential structural breaks. Using data spanning January 1995 and July 2007 we show that in Poland milk prices are asymmetrically transmitted along the food supply chain and that the causality runs from the retail industry to farm gate. Opposite results hold for milk prices in Hungary, where no asymmetry was found in either long- or short-run. Moreover, the causality between Hungarian prices runs from farm to retail sector. In Hungarian case, our results point also to the presence of structural break in late 2000. We argue that these differences between the investigated countries may be accounted for by differences in local sector's development during transition. Farm structure, market structure at the processing level as well as the role of FDI's are of special importance here.

REFERENCES

Aguiar, D. R. D. and Santana, J. A. (2002). Asymmetry in Farm to Retail Price Transmission: Evidence from Brazil, *Agribusiness,* Vol. 18, No. 1, pp.37-48.

Azzam A.M. (1999), Asymmetry in rigidity in farm-retail price transmission, *American Journal of Agricultural Economics*, Vol. 81, pp. 525-533.

Bakucs, L.Z., Fertő I. (2005), Marketing margins and price transmission on the Hungarian pork meat market. *Agribusiness* Vol. 21, No. 2, pp. 273-286.

Bakucs, L.Z., Fertő I. (2006), Marketing Margin and Price Transmission on the Hungarian Beef Market. *Food Economics* Vol. 3. (3-4) pp. 151-160.

Bakucs, L.Z., Fertő, I. (2008), Horizontal Integration on the Hungarian Milk Market. In: Csáki Csaba and Forgács Csaba (eds.): Agricultural Economics and Transition:„What was expected, what we observed, the lessons learned". Studies on the Agricultural and Food Sector in Central and Eastern Europe Vol. 44. Leibniz Insitute für Agrarentwicklung in Mittel and Osteurope, Halle, 2008. pp. 342-352.

Bojnec S., Günther, P. (2005), Vertical market integration and competition: the meat sector in Slovenia, *Agricultural and Food Science* 14 (3), pp. 236-249.

Brümmer B., v. Cramon-Taubadel S., Zorya S. (2006), Vertical Price Transmission between Wheat and Flour in Ukraine: A Markov-Switching Vector Error Correction Approach, paper presented at the 26th IAAE conference held at Gold Coast, Australia, August 12-18, 2006.

Capps O. Jr., Sherwell, P. (2007), Alternative Approaches in Detecting Aymmetry in Farm-Retail Price Transmission of Fluid Milk, *Agribusiness*, 23(3), pp. 313-331.

Csaki, C., Forgacs, C., Milczarek-Andrzejewska, D., Wilkin, J. (2008), Restructuring Market Relations in Food and Agricultrue in Central and Eastern Europe: Impacts on Small Farmer, Agroinform, Budapest, 2008.

Gohin, A. and Guyomard, H. (2000). "Measuring market power for food retail activities: French evidence", Journal of Agricultural Economics, 51, 181-195.

Gorton, M., Buckwell A., Davidova, S. (2000), Transfers and Distortions along CEEC Food Supply Chains, in: Tangermann S. and Banse M. (eds) Central and Eastern European Agriculture in an Expanding European Union, Wallingford Oxon: CABI Publishing, pp 89-112.

Hockmann, H. and Vőneki, É. (2008). Tacit Collusion in the Hungarian Market for Raw Milk Contributed paper presented at IAMO Forum 2008. Leibniz Insitute für Agrarentwicklung in Mittel and Osteurope, Halle.

Holloway, G.J. (1991), The Farm-Retail Price Spread in an Imperfectly Competitive Food Industry, *American Journal of Agricultural Economics*, 73 (4), pp. 979-989.

Jansik, C. (2002). Determinants and Influence of Foreign Direct Investments in the Hungarian Food Industry in a Central and Eastern European Context. PhD thesis. Agrifood Research Finland. Economic Research (MTTL).

Kinnucan H.W., Forker O.D. (1987), Asymmetry in Farm-Retail Price Transmission for major Dairy Products, *American Journal of Agricultural Economics*, 69, pp. 285-292.

Lass, D.A. (2005), Asymmetric response of retail prices in the northeast revisited, *Agribusiness*, vol. 21, Issue 4, pp. 493-508.

Lloyd T., McCorriston S., Morgan C.W., Rayner A.J., Weldegebriel H. (2006), Market Power in Uk Food Retailing: Theory and Evidence from Eight Product Groups, paper presented at the 80th AES Annual Conference, Paris, France 30-31 March, 2006.

London Economics, (2003). Examination of UK Milk Prices and Financial Returns, Report prepared for The Milk Development Council, February.

Lutkepohl, H., Kratzig, M. (eds.) (2004), Applied Time Series Econometrics, Cambridge: Cambridge University Press.

McCorriston, S., Sheldon, I.M. (2007), Trade Liberalization and Rent Distribution in Vertically-Related Markets, in: Swinnen, J.F.M. (ed.) Global Supply Chains, Standards and the Poor, CABI, Oxon.

McCorriston S., Morgan C.W., Rayner A.J. (2001), Price transmission: the interaction between market power and returns to scale, *European Review of Agricultural Economics* Vol. 28, No. 2, pp. 143-159.

McCorriston S., Morgan C.W., Rayner A.J. (1998), Processing technology, market power and price transmission, *Journal of Agricultural Economics* Vol. 49, pp. 185-201.

Pieniadz, A. and Hockmann, H. (2006). Explaining quality differences at the procurement stage in the Polish milk sector. Poster prepared for presentation at the IAAE Conference 12 – 18 August 2006. Gold Coast, Australia.

Pietrzak, M. (2007): Korzyści skali w przemyśle mleczarskim w Polsce (na przykładzie sektora spółdzielczego), Zagadnienia Ekonomiki Rolnej nr 1.

Serra T, Goodwin B.K. (2003), Price transmission and asymmetric adjustment in the Spanish dairy sector, *Applied Economics,* 35(18), pp. 1889-1899.

Seremak-Bulge J. (2005): Rozwój rynku mleczarskiego i zmiany jego funkcjonowania w latach 1990-2005, *Program Wieloletni* 21/2005, IERiGŻ, Warszawa.

Szabó, G. G. and Popovics, P**.** (2008)**:** Theoretical and practical approaches towards coordination and integration mechanisms: the case of the Hungarian dairy sector. Paper presented at the Seminar on „Pathways to Rural Economic Development in Transition Countries: The Role of Agricultural Cooperatives" ICA-ICARE, 05-06 September 2008, Yerevan, Armenia.

Swinnen, J.F.M. (ed.) (2006), Case studies on the dynamics of vertical coordination in agri-food chains in Eastern Europe and Central Asia, ECSSD Working Paper No. 42, World Bank, Washington, DC.

Swinnen, J.F.M., Dries, L., Noev, N. and Germeni, E. (2006), "Foreign Investments, Supermarkets, and the Restructuring of Supply Chains: Evidence from Eastern European Dairy Sectors", LICOS Discussion Papers 165/2006.

Yon Cramon-Taubadel, S. (1998), Estimating Asymmetric Price Transmission with the Error Correction Representation: An Application to the German Pork Market, *European Review of Agricultural Economics*, Vol. 25: 1-18.

Wilkin, J., Milczarek, D., Malak-Rawlikowska, A. and Fałkowski, J. (2006), "The Dairy Sector in Poland", in series: Regoverning Markets Agrifood Sector Study, International Institute for Environment and Development (IIED), London 2007.

White, J. and Gorton, M. (2006). A Comparative Study of Agrifood Chains in Moldova, Armenia, Georgia, Russia and Ukraine. In: Swinnen, J. F. M (ed.). The Dynamics of Vertical Coordination in Agrifood Chains in Eastern Europe. Washington D.C.: World Bank, pp. 5-44.

Discussion Papers published in 2012

Judit Karsai: Development of the Hungarian Venture Capital and Private Equity Industry over the Past Two Decades. MT-DP 2012/1

Zsolt Darvas: A Tale of Three Countries: Recovery after Banking Crises. MT-DP 2012/2

Zsombor Z. Méder - András Simonovits - János Vincze: Tax Morale and Tax Evasion: Social Preferences and Bounded Rationality. MT-DP 2012/3

Fertő Imre: Szerződések kikényszeríthetősége a magyar élelmiszerláncban: a kis- és közepes vállalkozások esete. MT-DP 2012/4

Helga Habis and P. Jean-Jacques Herings: Stochastic Bankruptcy Games. MT-DP 2012/5

Štefan Bojnec - Imre Fertő: EU Enlargement and Agro-Food Export Performance on EU Market Segments. MT-DP 2012/6

Judit Markus - Miklos Pinter - Anna Radvanyi: The Shapley value for airport and irrigation games. MT-DP 2012/7

Andras Simonovits: Optimal cap on pension contributions. MT-DP 2012/8

Maria Csanádi: Economic and systemic consequences of adaptation to external and internal pressures caused by global crisis in China. MT-DP 2012/9

Zsolt Darvas: Real effective exchange rates for 178 countries: A new database. MT-DP 2012/10

Péter Biró - Matthijs Bomhoff - Petr A. Golovach - Walter Kern - Daniel Paulusma: Solutions for the Stable Roommates - Problem with Payments. MT-DP 2012/11

Discussion Papers are available at the website of Institute of Economics Hungarian Academy of Sciences: http://econ.core.hu