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What causes asymmetric price transmission in agro-food sector? Meta-analysis perspective

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What causes asymmetric price transmission in agro-food sector? Meta-analysis perspective

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Abstract

There now exists a large literature on price transmission in agro-food sectors. However, a great majority of empirical studies focus on the existence of asymmetry and, by and large, do not allow investigating the reason for its presence or absence. This is in sharp contrast to the theoretical literature that provides a number of explanations for why we should expect (a)symmetry. In response to this, this paper tries to uncover the reasons for asymmetric price transmission in the agro-food chain. To do so, we use meta-analysis drawing on the existing studies from this area. Our focus is on the organizational and institutional characteristics of the agro-food supply chain. Our findings suggest that asymmetric price transmission in farm-retail relationship is more likely to occur in sectors/countries with more fragmented farm structure, higher governmental support and more restrictive regulations on price controls in retail sector. On the other hand, more restrictive regulations on entry barriers in retail sector and relative importance of the sector in question tend to promote symmetric farm-retail price transmission. The latter is also more likely in the presence of strong processing industry.

Keywords: price transmission, meta-regression analysis, agro-food supply chain

JEL classification: Q11

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Aszimmetrikus agrár-/élelmiszerár-transzmisszió okai Metaelemzés

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Összefoglaló

Immár gazdag irodalom foglalkozik az agrárpiacok ártranszmissziójának kérdéskörével. Az empirikus kutatások nagy része ugyanakkor pusztán az aszimmetria jelenlétének a vizsgálatára szorítkozik, és nem magyarázza az ezt előidéző folyamatot. Mindez éles ellentétben áll az ártranszmisszió elméleti irodalmával, amely számos (elméleti) magyarázattal szolgál az ártranszmissziós (a)szimmetria előfordulására vonatkozóan. Tanulmányunkban megkíséreljük felderíteni az agrár-élelmiszeriparban megfigyelt ártranszmissziós (a)szimmetria lehetséges okait. Kutatásunkban metaelemzést alkalmazunk, amely a nemzetközi irodalomban fellelhető empirikus publikációk eredményeire épít. Tanulmányunk fókuszában az agrár-élelmiszeripari kínálati lánc szervezési és intézményi sajátosságai állnak. Eredményeink azt mutatják, hogy az ártranszmissziós aszimmetria előfordulása valószínűbb az elaprózott bírtokstruktúrával rendelkező ágazatok/országok, a nagyobb kormányzati támogatás, valamint a kiskereskedelmi szektor restriktívebb hatósági árképzési kontrollja esetén. Másrészt, ahol restriktívebb korlátokkal szembesülnek a piacra belépni kívánó kiskereskedelmi egységek, vagy nagy a vizsgált ágazat (nemzetgazdasághoz viszonyított) relatív fontossága, ott a szimmetrikus termelő/fogyasztó ártranszmisszió jelenléte valószínűbb. Hasonló következtetésre jutunk, ha a feldolgozószektor „erős” a kiskereskedelmi ágazathoz képest.

Tárgyszavak: ártranszmisszió, metaelemzés, agrár-élelmiszeripari termékpálya

JEL kódok: Q11

1. INTRODUCTION

Market volatility remains one of the most important research fields in agricultural economics. On one hand, this is of relevance from micro-perspective as large and unexpected price movements strongly affect agricultural households' welfare. On the other hand, market distortions are often cited as a ground for state intervention. In this sense, the problem of market volatility is also high on the agenda from macro-perspective. To better understand the nature of price movements economists made some effort to analyse the mechanism of price transmission, i.e. the way that price movements are transmitted along the various stages of the agro-food chain (from farm to processing and retail levels or vice versa).

Studies from this field have tried to see whether price decreases are transmitted along the chain with equal speed and/or magnitude as price increases. In recent years a number of empirical works have been published that greatly improve our knowledge in this respect (see for example Meyer and von Cramon-Taubadel, 2004 for an overview). This was possible, among others, thanks to huge advancement in econometric tools in general, and time series analysis in particular. However, the findings of these studies are ambiguous. Asymmetries in price transmission have been detected in some countries and sectors but not in others. This leads to a general conclusion that the presence of (a)symmetric price transmission is conditional on local circumstances. It is disturbing though, that the exact mechanisms through which these local conditions affect the nature of price movements remain mostly unknown.

This is interesting since there are a number of theoretical arguments that try to explain why price transmission could be asymmetric. In fact, as far as the causes of price transmission asymmetries are concerned, the recent literature has paid much more attention to theory than empirics. Among the arguments that have been provided to account for asymmetric price movements the most commonly cited is the presence of market power in retail and/or processing industries (see e.g. McCorriston et al., 1998, 2001). Market power in downstream sectors may affect price transmission by depressing purchasing prices in upstream sectors below the level of a perfectly functioning market, and/or deter entry or foster exit. Asymmetric price transmission can also result from the search costs (Miller and Hayenga, 2001). In such case, costumers, although having a finite choice of competing retailers, may not be able to find relevant price information, enabling retailers to exercise local market power. Other reasons for asymmetric price transmission include the so-called 'menu costs' argument (i.e. costs occurring with the re-pricing and the adoption of a new pricing strategy (see, e.g., Bailey and Brorsen, 1989; Levy et al., 1997), the presence of

inflation (relevant in economies characterised by high inflation rates and/or prolonged inflationary environment (see, e.g., Ball and Mankiw, 1994), government support (Kinnucan and Forker, 1987) or various stock management practices (Reagan and Weitzman, 1982; Wohlgenant, 1985; Balke et al., 1998).

Given this stark difference between theoretical work and empirical application, this paper tries to link the presence of price (a)symmetries with exact causes. The characteristics of food markets suggest that these markets are typically oligopolistic (Sexton and Lavoie, 2001; Sheldon and Sperling, 2003), thus our focus is on the organizational and institutional characteristics of the agro-food supply chain that are likely to affect market power. Given the concerns about the growing market power of food retailers, we mainly concentrate on the latter.

As mentioned in other studies (see McCorriston, 2002; and Meyer and von Cramon-Taubadel, 2004), the empirical study of the link between market power and asymmetric price transmission presents several challenges. These are mostly related to the issue of retail market power measurement and lack of sufficient variation in market power variables. In response to this, we propose two innovations. First, we proxy the organisation of retail sector with various regulatory indicators that have important advantages over the commonly used market concentration ratios. We also complement these measures with variables approximating market structure and/or bargaining power of actors at other stages of the agro-food sector. This way we link the presence of price transmission asymmetry not only to developments in the retail sector, but to various characteristics of the agro-food chain as a whole. Second, to take advantage of the fact that the market organisation varies considerably across countries and/or sectors, our empirical strategy is based on meta-analysis and draws on the results of recent papers from the price transmission field. By doing so, we aim at complementing the existing literature on price transmission by providing some systematic evidence on the causes of asymmetric price movements along the agro-food supply chain.

The closest contribution to our paper is the study by Frey and Manera (2007), who employ meta-analysis to studies on price transmission in agricultural and oil markets. Three key differences distinguish our approach from theirs. First, we concentrate on research published after 2003, resulting in only two common papers. This could be of importance, as one can assume that the results from recent papers are based on a more robust methodology, encompassing continuous improvements in time series econometrics. Thus we aim to reduce the risk of biased results due to misspecification errors that may have affected earlier price transmission studies. Second, we restrict our sample to studies covering only European agricultural markets. This, in turn, reduces, at least to some extent,

the risk that cases under our investigations are not comparable to each other[1]. Third, and perhaps most importantly, Frey and Manera (2007) document only the relationship between the presence of price (a)symmetry and methodological approaches used in the analysed studies. We instead propose to link price transmission (a)symmetry not only to methodological approaches, but also with socio-economic and institutional characteristics of sectors/markets under investigation. This is important as it allows to relate our results to existing theoretical predictions. Thus, except for applying the 'old approach' to new data, we also present new results. While the data that we use have some limitations, we nonetheless believe that this approach may still offer some new insights on the phenomenon of (a)symmetric price transmission.

The remainder of the paper is organised as follows. Section 2 presents our methodological approach and the data that we use in the empirical analysis. Section 3 displays our results and Section 4 concludes.

2. METHODOLOGY

Based on the existing theoretical literature, price transmission mechanism could be thought of as a function:

$$p_{cs} = W(X_{cs}) \quad (1)$$

where p denotes the variable that characterises the presence of price transmission asymmetry, and X are the socio-economic market characteristics, both referring to country c and sector s. W(.) is the reduced-form function that aims at capturing potentially complex interactions between these two. X includes, for instance, market structure, regulatory framework or bargaining power of actors operating at subsequent stages of the agro-food supply chain. The mapping from socio-economic characteristics into price transmission mechanism induced by (1) can be studied empirically. To do this, consider the following empirical model of the form:

$$p_{cs} = \delta_c + \gamma_s + \beta X_{cs} + \varepsilon_{cs} \quad (2)$$

where δ_c is a country fixed effect, γ_s is a sector fixed effect and ε_{cs} is an error term. β is a vector of coefficients to be estimated.

Given the fact that the within-country variation in variables included in X is limited, we focus on exploiting the between country variation. What follows, our dependent variable draws on the results from the existing studies on price transmission (see further).

1 Obviously there is still a great amount of heterogeneity within European agricultural markets. Nevertheless, organization of the European markets, especially those within the EU borders, assures somewhat more reliability of the within European comparisons as compared to American-European or Asian-European comparisons.

Therefore, we couch our empirical analysis in a meta-analysis framework. Meta-analysis is the quantitative analysis of a body of studies and aims at evaluating the existing empirical evidence (Stanley, 2001). While originally it was used in research areas other than agricultural economics, recently it is quickly entering this field as well. Recent 'agriculture-oriented' studies that use this approach include, among others, Hess and von Cramon-Taubadel (2007), Gallet (2007, 2010), Johnston and Duke (2009) or Lagerkvist and Hess (2011).

Our empirical strategy is as follows. Based on the literature review, we identify studies that investigate price behaviour in a number of countries and sectors. We code our dependent variable as a dummy equal to one if a given paper found asymmetric price transmission and equal to zero otherwise. In a second step, drawing on various sources, we collect the data on various socio-economic and institutional characteristics of countries and sectors covered by the identified studies. Given the theoretical predictions concerned with price transmission asymmetry, we mainly focus on characteristics that may be related to the organization of the subsequent stages of the agro-food supply chain. Thus, our focus is on variables approximating market structure and bargaining power of farmers, processors and retailers. This way we exploit the variation in market characteristics across countries/sectors. This helps us to overcome the main shortcoming of 'single-sector' studies that can hardly measure the impact of market structure on price transmission unless the organisation of the agro-food sector in the given country/sector suffers important changes within the study period (Meyer and von Cramon-Taubadel, 2004).

While the approach we follow presents an important advantage, it also creates an major challenge. As mentioned by McCorriston (2002), finding a suitable proxy for market structure may pose a substantial difficulty. On one hand, this proxy should be uniform and comparable across countries. On the other hand, it should effectively capture the behaviour of farmers/processors/retailers and not just the potential that these actors have to behave in a certain way. We try to address these issues by using various proxies of the market structure at subsequent stages of the agro-food supply chain and follow the literature with respect to the way we define them (see further). While the measures we use may still be subject to the abovementioned critique, we are not aware of any better proxies available for such number of countries/sectors. Thus, while this caveat should be kept in mind when interpreting our results, we nonetheless believe that our findings can provide some new insights on the linkage between various characteristics of agro-food supply chain and price transmission (a)symmetry.

In order to check the robustness of our analysis we estimate two alternative specifications, parametric and semi-nonparametric ones. In addition, to address the concern that multiple-results studies may dominate our estimates, both an unweighted and

a weighted version of equation (2) are estimated. We follow Hess and von Cramon-Taubadel (2008) and use as a weight the importance of each observation which is calculated as a ratio of 1 over the number of observations resulted from the underlying study.

In principle, meta-analysis investigates the extent to which statistical heterogeneity between results of multiple studies can be related to methodological characteristics of models that these studies apply. Therefore, in our regression analysis we also check whether the identified price transmission results are influenced by these methodological characteristics. Consequently, in addition to estimating equation (2), we also investigate the following relationship:

$$p_i = [\![F(ET_i, FREQ_i, OMC]\!]_i, \mu_i) \quad (3)$$

where i denotes the study under investigation, ET stands for estimation technique; FREQ describes the data frequency, OMC include other model characteristics (whether it is a multiple-results or single result study; sample size) and μ is an error term. It should be emphasised however, that our aim is not to assess in any way whether these approaches were appropriate. Instead we wish to assess whether methodological choices have any impact on the obtained results.

3. DATA

As far as the data on the presence/absence of price transmission is concerned, we draw on the results from 20 recent papers from the price transmission literature. These studies focus on European agricultural sector and investigate price transmission mechanism for 69 cases. Detailed list of these papers is presented in Table 1. To our knowledge, this is the most comprehensive list of studies investigating price behaviour along the European agro-food chain. It was based on various scientific data bases including Scopus, Science Direct, Emerald, EconLit, Web of Science and Google Scholar.

Table 1.

List of identified studies on price transmission in European agro-food chain

Paper	Country	Sector
Bakucs et al. (2006)	Germany	pork
Bakucs et al. (2007)	Hungary	Vegetables
Bakucs & Ferto (2005)	Hungary	Pork
Bakucs & Ferto (2008)	Hungary	Milk
Bakucs & Ferto (2006)	Hungary	Beef
Bakucs & Ferto (2009)	Hungary	Pork
Ben-Kabia & Gil (2007)	Spain	Lamb
Bojnec & Peter (2005)	Slovenia	Pork
	Slovenia	Beef
Cechura & Sobrova (2008)	Czech Republic	Pork
Fałkowski (2010)	Poland	Milk
Fernandez et al. (2010)	Austria	Apple
Guillen & Franquesa (2010)	Spain	Pork
	Spain	Beef
	Spain	Eggs
	Spain	Lamb
	Spain	Rabbit
	Spain	Poultry
Hassouneh et al. (2010)	Spain	Beef
Karantinis et al. (2011)	Sweden	Pork
London Economics (2004)	Austria	Carrot
	Austria	Potato
	Denmark	Vegetables
	Denmark	Bread
	Denmark	Flour
	Denmark	Eggs
	France	Bread
	France	Poultry
	Germany	Apple
	Germany	Potato
	Germany	Carrot
	Germany	Poultry
	Germany	Milk
	Germany	Cheese
	Germany	Butter
	Netherlands	Potato
	Netherlands	Beef
	Netherlands	Bread
	Netherlands	Eggs
	Spain	Potato
	United Kingdom	Fruit
	United Kingdom	Vegetables
	United Kingdom	Vegetables
	United Kingdom	Beef
	United Kingdom	Lamb
	United Kingdom	Bread
	United Kingdom	Eggs
	United Kingdom	Milk
Luoma et al. 2004	Finland	Pork
Luoma et al. 2004	Finland	Beef
Reziti & Panagopuolos (2008)	Greece	Vegetables
	Greece	Fruit
	Greece	Food
	Greece	Vegetables
	Greece	Fruit
	Greece	Food
Rezitis & Reziti (2011)	Greece	Milk
Serra & Goodwin (2003)	Spain	Milk
	Spain	Milk
	Spain	Milk
	Spain	Milk

Next we briefly present some basic information on the studies that we use in our analysis. Most importantly, price transmission asymmetry has been detected in 28 cases whereas in the remaining 41 cases the authors concluded symmetric price behaviour. While price transmission could be analysed for different pairs of actors operating at various stages of the agro-food supply chain, almost all of the cases that we identified (67) relate to farm-retail price transmission. The remaining two cases relate to farm-wholesale relationship and to farm-processor relationship. As presented in Table 2, our sample is not uniformly distributed over geographic regions or countries. Most of the observations, 57, are for the Western Europe (the so-called 'Old EU Members') and only 12 are for the Central and Eastern European countries (New Member States). Moreover, five countries, namely Spain, the United Kingdom, Hungary, Germany and Greece account for almost 2/3 of the entire sample.

Table 2.

Number of observations by country

Country	N	% of all obs.	% of all cases detecting APT
Austria	5	7.2	10.7
Czech	1	1.4	3.6
Denmark	4	5.8	0.0
Finland	2	2.9	0.0
France	2	2.9	3.6
Germany	8	11.6	7.1
Greece	7	10.1	14.3
Hungary	8	11.6	7.1
Netherlands	4	5.8	0.0
Poland	1	1.4	3.6
Slovenia	2	2.9	3.6
Spain	14	20.3	35.7
Sweden	3	4.3	7.1
United Kingdom	8	11.6	3.6
Total	69	100.0	100.0

Source: Own calculations based on literature sample

Further, as reported in Table 3, most of the cases under investigation (43) concern livestock products. Crop production is represented by 26 observations, and thus accounts for roughly 38% of our sample.

Table 3.

Number of observations by sector

product	N	% of all obs.	% of all cases detecting APT
livestock	43	62.3	82.1
vegetables	8	11.6	7.1
fruit	5	7.2	0.0
food	2	2.9	7.1
potato	6	8.7	0.0
cereals	5	7.2	3.6
total	69	100.0	100.0

Source: Own calculations based on literature sample

Tables 4-6 present some methodological characteristics of the studies under consideration. The majority of cases, 52 (75%), couch the analysis in a vector error correction models (VECM) framework. 12 studies, i.e. 17% of the total number of observations, use threshold VECM approach. There are a few studies that are based on the earliest methodological approach to investigate price transmission mechanism, namely pre-cointegration techniques (6 cases, i.e. roughly 9% of all identified studies).2 Further, the majority of studies use monthly rather than weekly data (Table 5). Finally, of the 56 studies that investigated the direction of price information flow, 20 report the causality running from farm to retail, 7 reports the opposite direction, whereas 29 report the causality running in both directions (Table 6).

Table 4.

Number of observations by methodology

methodology	N	% of all obs.	% of all cases detecting APT
Houck	6	8.7	14
VECM	40	58.0	32
TVECM	12	17.4	7
Gregory-Hansen	4	5.8	32
Regime switching	1	1.4	4
General-to specific	3	4.3	4
Asymmetric non-linear auto regressive distributed lag model	3	4.3	7
total	69	100.0	100

Source: Own calculations based on literature sample

[2] As one of the earliest application of this approach was the study by Houck (1977), in Table 4 we refer to it as 'Houck approach'.

Table 5.

Number of observations by data frequency

frequency	N	% of all obs.	% of all cases detecting APT
monthly	62	89.9	82.1
weekly	7	10.1	17.9
total	69	100.0	100.0

Source: Own calculations based on literature sample

Table 6.

Number of observations by causality

causality direction	N	% of all obs.	% of all cases detecting APT
causality farm to retail	20	35.7	52.6
causality retail to farm	7	12,5	10.5
bidirectional causality	29	51,8	36.8
total	56	100.0	100.0

Source: Own calculations based on literature sample;

Dependent variable

As mentioned earlier, our dependent variable shows the presence/absence of price transmission asymmetry. Accordingly, it is a dummy variable equal to one if the paper detects asymmetric price transmission and equal to zero if symmetric transmission has been detected.

Independent variables

The selection of explanatory variables included in our regression is a crucial decision, since they should be consistent with theories providing explanations for the presence of price transmission asymmetry. On the other hand however, inflating the number of socio-economic characteristic variables, quickly reduces the degrees of freedom and induces potential multicollinearity in regression results. Thus, to investigate the effect of the agro-food supply chain characteristics upon price transmission asymmetry, we include a limited number of covariates.

The first three of them refer to the organisation of the farming sector. Variable relative_weight measures the relative size of the sector, captured by the number of farm holdings operating in a given sector (standardized over total number of farm holdings in a given country). The inclusion of this variable is supported by predictions originating from the interest group theory that relates the strength of an interest group to a number of its members (Olson, 1965). According to this theory, the larger the group, the higher

transaction costs need to be in order to decide about, and undertake, certain actions. It follows, this variable is expected to positively affect the presence of price transmission asymmetry as it should be negatively correlated with farmers' bargaining power. Another somewhat related argument points to the fact that the higher the number of farmers in a given production sector, the easier it should be for the retailer to find a potential supplier. To construct this variable, we use the EU Farm Accountancy Data Network (FADN).

To further control for farmers' bargaining power, we also include two other variables aiming to capture the sector's farm structure. On the one hand, we control for the share of land utilised by farm holdings of economic size between 0 and 4 ESU (variable 0_4_ESU). This way we control for the relative farm fragmentation/importance of the smallest farms. To also control for the other extreme, we include the variable 100_over_ESU which measures the share of land operated by farm holdings equal to, or larger than 100 ESU. This variable aims at capturing the relative strength of largest farms. Since it is plausible to assume that farm's economic size is positively related to its bargaining position vis-a-vis downstream sector, we expect the variable 0_4_ESU (100_over_ESU) to have a positive (negative) effect on the probability to observe asymmetric price transmission. These data also come from the FADN.

While the former three variables aimed at capturing most important characteristics of the farm sector, we also control for main characteristics of the retail sector. In general, there are two main problems with variables that could be used here. First, the literature is not unanimous with respect to the proxy that one should use to measure the retailers' bargaining power (see e.g. Meyer and von Cramon-Taubadel, 2004). Second, even if we assume that the first problem is solved, it is still quite difficult to find the data on a uniform measure that would be available for more than a few countries. Given these problems and the ongoing debate, we focus here on regulations governing the retail trade. These data come from the OECD and were collected via the OECD Regulatory Indicators Questionnaire (Conway and Nicoletti, 2006). While these data point to a number of important aspects of the functioning of retail sector, it should be noted that the regulatory indicators that we use concern the whole retail sector and not just food retailing as such. This should be kept in mind while interpreting our results. More specifically, we look at regulations related to entry barriers, operation restrictions, and pricing policies. These data seem to have an important advantage over the commonly used market concentration ratios. They allow capturing an institutional environment within which retailers operate, regardless of their market share. Thus, we believe that they allow capturing important constraints that shape interactions within a retail sector and between retailers and upstream sectors in the agro-food chain. Thus our regulatory indicators aim to capture, at least partly, the incentive structure that retailers face and that drive their behaviour, an issue which cannot be

captured by a downstream market power index. Also note, that institutional features, including the regulations governing retail trade, are commonly assumed to be exogenous. This is of importance from an econometric point of view and presents additional advantage over a simple market concentration ratio which is likely to be endogenous. Obviously the validity of this assumption would depend on the extent to which these regulations do not vary over time. Based on these data we construct three variables: entry_barriers, operational_restrictions and price_controls. Each index is ranging from 0 to 6 with higher values indicating more restrictive regulations. The former two variables seem to act in favour of smaller retailers as compared to large-scale retailers (normally entry barriers and/or operational restrictions relate to hyper- and super-markets rather than to smaller shops). If this is the case, they improve farms' bargaining position vis-a-vis retailers, to the extent they contribute to a more balanced bargaining power between farms and retailers, and thus they should promote symmetric price transmission. It should be noted however, that entry barriers shelter incumbent retailers and this should strengthen bargaining position of the latter. It follows, that an opposite effect of entry_barriers cannot be excluded. As far as the expected impact of price_controls on price transmission asymmetry is concerned, it should be positive. This is because, limits imposed on the price competition between retailers may result in stronger pressure to use vertical pricing policy to increase market share. Asymmetric price adjustments can be regarded as an example of such policy.

To have a complete coverage of subsequent stages of the agro-food supply chain, we also include a variable measuring the relative strength of the processing industry. Variable food_retail measures ratio of the average turnover per manufacturing enterprise in a given agricultural sector to average turnover per retail enterprise in a given agricultural sector. The average is calculated over the period 1995-2008.[3] This variable is based on Eurostat data.

In addition, to account for the fact that price transmission mechanism can be related to government intervention, the average value of Nominal Rate of Assistance (NRAavg) (by product during analysed period) is included among regressors. The NRA measures the total transfer to agriculture as a percentage of the undistorted unit value and comes from World Bank Agricultural Distortion Database (www.worldbank.org/agdistortions). According to theory, we expect this variable to positively influence the presence of asymmetric price transmission.

Finally, to take into account geographical and, to some extent, historical characteristics of sectors/countries covered in our sample, we classify countries into two groups: Western refers to old EU member states whilst Eastern describes Central European countries.

[3] In some cases however, data was not available for the full period, thus the average calculated over the shorter time-span was used.

As far as the regressions linking price transmission asymmetry to methodological aspects are concerned, we use the following explanatory variables. Variable Houck is a dummy distinguishing papers that use the pre-cointegration approach. Variable VECM on the other hand is a dummy distinguishing studies relying on vector error correction models. All other papers, i.e. those that rely on non-linear methodologies, act as a reference group. Given that methodological advancements in econometrics allow for a much more detailed scrutiny of the data, we expect the more recent methods, i.e. non-linear ones, to be more likely to detect some imperfections in price transmission mechanism and thus the presence of asymmetric price transmission. Further, as mentioned in some studies (see e.g. Frey and Manera, 2007; Meyer and von Cramon-Taubadel, 2004; or von Cramon-Taubadel et al., 2006) the outcome of price transmission investigation may depend on the frequency and aggregation characteristics of the data used. More specifically, less frequent data may mask important adjustments (or lack of those) that occure within shorter periods. To address this issue, in our methodological regressions we also include the dummy variable monthly capturing studies with monthly data frequency. Studies with weekly data act as a reference point. In accordance with the argument presented above, we expect a negative coefficient on this variable suggesting that studies with monthly data are less likely to detect price transmission asymmetry than studies with weekly data.

4. RESULTS

In order to examine the relationships between asymmetric price transmission and explanatory variables, we estimated various binary models. The binary models are typically estimated by maximum likelihood after imposing distributional assumptions of error term. However, semi parametric literature emphasise that parametric estimators of discrete choice models are known to be sensitive to departures from distributional assumptions. Various estimators have been developed for correcting this restrictive nature of parametric models including semi-nonparametric approach of Gallant and Nychka (1987) and the semi parametric maximum likelihood approach of Klein and Spady (1993). Recent literature emphasises that semi-nonparametric and semiparametric maximum likelihood estimators substantially dominate the parametric probit maximum likelihood estimator (De Luca 2008). Therefore, in this paper we employ semi-nonparametric approach.

We begin with a brief presentation of the results that were obtained from estimating equation (3), i.e. 'methodological specification'. They are reported in Table 7 and can be summarised as follows. First, in line with our expectations, the probability to detect asymmetric price transmission is higher for studies using methodological approaches other than Houck or VECM. Second, asymmetries are more likely to be found in studies using weekly rather than monthly data and in studies with a larger sample size. This is fully in line

with arguments and findings presented elsewhere (e,g. von Cramon et al., 2003; Frey and Manera, 2007). Third, there is also some evidence that asymmetries are found more often for livestock rather than crop products.

Table 7.

Price transmission asymmetries & modelling approach – semi-nonparametric maximum likelihood estimator

	1	2	3	4
		weighted		weighted
VECM	-3.947***	-3.341***	-2.234***	-1.928***
Houck	-2.078*	-1.606**	-4.153***	-4.467***
Monthly	-1.696	-1.656	-3.950***	-4.586***
Number of observation	-0.013**	-0.012**	-0.009***	-0.007
Livestock			2.417***	1.855***
Log pseudolikelihood	-37.6045	-12.619	-35.926	-12.377
N	69	69	69	69

Source: Own computations

We now move to present results from specifications linking the presence of price transmission asymmetries to socio-economic characteristics of the agro-food chain. Our main results are reported in Table 8. Columns 1,3,5 report unweighted regressions whereas columns 2,4,6 report weighted regressions. Our basic specification is presented in columns 1 and 2. The other columns present specifications with additional covariates thus checking for the robustness of findings. Several interesting points arise from this analysis. First, contrary to what could be expected from Olson's (1965) interest group theory, the coefficient of the relative_weight variable is persistently negative and in most cases statistically significant. It follows that the probability of asymmetric price transmission is lower, the bigger the sector under investigation. A possible explanation of the negative coefficient might be that a higher share of farms operating in a specific sector with respect to total number of farms reflects the importance of that sector for politicians and regulators. This refers to political economy considerations that put both social as well as voting issues to the front. The next two explanatory variables provide further insights about the role that farm structure may play for price transmission mechanism. As shown in Table 8, asymmetric movements are positively correlated with the share of land operated by the smallest holdings classified between 0 and 4 ESU. This results however is slightly less robust than the previous one, as in the weighted regressions the estimated coefficients are never statistically significant. Together these results suggest that the presence of asymmetric price transmission is more (less) likely the more fragmented (concentrated) is the farm structure which is fully consistent with expectations.

Table 8.

Price transmission asymmetries & agro-food supply chain characteristics – semi-nonparametric maximum likelihood estimator

	1	2	3	4	5	6
		weighted		weighted		weighted
Entry_barriers	-0.400*	-0.357	-1.006***	-1.059***	-1.748***	-1.603***
Price_control	0.247	1.065***	0.862**	2.789***	0.682*	1.006***
Operational_restrictions	0.160	-0.021	0.366	-0.243	0.724**	1.642***
Relative_weight	-2.458***	-4.467**	-4.421	-9.303***	-3.327	-11.669***
0_4_ESU	8.232***	-0.544	17.442***	-1.315	28.837***	5.391
100_over_ESU	1.732*	-1.649	2.761	-2.103**	1.994	-1.444*
Food_retail	-0.047***	-0.057***	-0.023**	-0.050***	-0.026	-0.051***
NRAavg			0.638	1.328**	2.071***	1.394***
Western					-1.124*	-3.492***
Log pseudolikelihood	-24.622	-5.490	-19.113	-3.5423	-18.022	-3.206
N	57	57	45	45	45	45

Moving on to the impact of regulations affecting the retail sector, we find that asymmetric price transmission is less likely in a scenario where retailers' activities are constrained by entry_barriers regulations and this result seems to be very robust. At first glance, this result could be counter intuitive as entry barriers shelter incumbents from potential rivals and thus may lead to increased margins and, possibly, more rigid price adjustments. Note, however, that entry barriers, if put in place, are mostly directed against large-scale retailers. This, in turn, should act in favour of smaller retailers, possibly allowing them to increase their market share. Given that retailers' size should be an important determinant of their bargaining power, this may at the same time be beneficial to farmers. Consequently, our results are consistent with the considerations stating that the more balanced the bargaining power of farmers and retailers, the more likely one should observe symmetric price transmission.

Quite surprisingly, we find some evidence that price transmission is more likely to be asymmetric in the presence of regulations restricting large retailers opening hours (operational_restrictions). While we expected this variable to affect price transmission mechanism in similar vein as entry_barriers, apparently some more inquiry into this specific regulation should be taken in future work to explain this discrepancy.

Further, robust results (price_control variable) indicate that price movements tend to be more asymmetric if price competition between retailers is limited (price controls may forbid, for instance, putting the dumping prices/keeping retail prices too low). A possible interpretation to account for this result could be the following. Price controls (strongly)

limit the set of 'horizontal-competition' tools that retailers may use to increase their market share. Consequently, they may resort to 'vertical-competition' tools, i.e. try to increase their market share through delayed and/or asymmetric adjustments in prices along the supply chain.

We next look at the potential impact of the processing industry, and find that farm-retail price transmission asymmetry is less likely to occur when food manufacturing turnover (per enterprise) relative to retailers' turnover is higher (food_retail variable). A potential explanation draws on the fact that in the situation where processing industry plays a dominant role in the supply chain, price asymmetries may now move to farm-processor and processor-retailer relationships. In such case, farm and retail prices may move together, so symmetric transmission is more likely to be observed. Available data unfortunately do not enable us to directly test this hypothesis.

Regarding the impact of government intervention, results are as expected and in line with theory formulated by Kinnucan and Forker (1987). More specifically, we find a positive influence on price transmission asymmetry, suggesting that downstream industries are (perfectly) aware and anticipate government farm intervention when deciding upon pricing strategies.

Finally, the sign of the Western dummy variable indicates that price transmission asymmetry is more often found in studies examining price movements in 'Old EU Member States' as compared to studies investigating the situation in NMS.

5. CONCLUSIONS

In this paper we investigate the underlying reasons for price transmission (a)symmetries. Our methodology rests on meta-analysis and thus empirical results obtained from a number of studies in the field. More specifically, we try to relate the presence/absence of price transmission asymmetry in farm-retail relations detected by the existing studies to various characteristics of the agro-food supply chain. Our focus is on factors that are likely to affect the bargaining power of actors operating at subsequent stages of the supply chain. In addition, we investigate the extent to which the results found in the literature on price transmission are influenced by the methodological approaches that formed the basis for these findings.

Overall, our results are in line with the existing theories predicting that price transmission asymmetries are more likely in the presence of (retailers') market power. More specifically, we find that asymmetries are present in sectors with higher number of fragmented farm producers and less likely to occur with more concentrated farm structure.

Interestingly, price transmission mechanism seems to be symmetric in sectors that are likely to be of high political clout. Further, price transmission asymmetries seem to be related to regulatory framework that governs the operation of retail sector. Our results suggest that asymmetries are less likely in the presence of entry barriers on retail trade but more likely in the presence of operational restrictions. On the other hand, distortions in the price relationship between retailers and suppliers are more likely to occur in the presence of regulations limiting price competition between retailers. Finally, we show some evidence that farm-retail price relationship tends to be asymmetric in the presence of governmental intervention and symmetric in the presence of strong processing sector. The latter may be valid if processors are dominant players in the supply chain and thus influence both farm and retail prices.

Obviously, there is a question to what extent our results are affected by the, so called, omitted variables bias. Note that our data do not provide any information about stock management practices or menu costs, i.e. factors that are mentioned as important price transmission determinants in addition to market power. This, in turn, may impact our results. Further, we do not have any direct measure on the bargaining power of agents operating at subsequent stages of the supply chain. Consequently, we have to rely on proxies. This obviously raises the question whether these proxies are indeed appropriate. These issues clearly point that the results we show should be treated with caution. Nevertheless, we believe that the approach that we adopt here can help improving our understanding of factors responsible for asymmetric price movements. Clearly, much remains to be done, however we hope this paper is a building block towards bridging the gap between theory and empirics with respect to the causes of (a)symmetric price transmission.

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