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Vertical price transmission between market operators in Hungarian agricultural product chains

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Abstract

Price transmission studies related to the cointegration of price time series are a suitable means for studying market dominance at the various market levels in the food product chains. For this study a price transmission asymmetry study was carried out for 18 commercial food product chains. In this study a monthly price time series was used for the period 2001 to 2005. It was found that there is significant product variation in market dominance which spans the entire industry. However, the variation is not significantly linked to either sectors or vertical levels. At times it is unstable and can easily tilt toward the vertical partner level. Depending on price changes, it can also vary, which, in turn, reflects changes in weather conditions. Following a radical change in prices, there is almost never enough time to achieve full price restoration before the onset of another price shock. The fact that prices are not fully restored may partly explain the continuing value divergence of agricultural prices.

Keywords

price transmission, cointegration, market power, food product chain, Hungary

Introduction

For obvious reasons Hungarian agricultural producers tend to be immobile. This is because their experience and assets are difficult to convert into other activities. Moreover, agriculture is not only a living, but also a way of life. As market operators, they frequently accept unfavourable input and output prices over long periods of time, and thus regularly suffer losses. To compensate for this they are given agricultural subsidies. This holds true at the the local market level for agricultural products. At the local market level there may very well be smaller yet more sophisticated price deviations according to local market power relationships. Such transmission of value through prices is called price transmission. In fact, producers may at times benefit from the process. The positive or negative differences between the actual price and the local benchmark equilibrium price reflect these value-diminishing or value-increasing trends.

Cointegration means the joint movement of various time series. In that sense, cointegration may exist between the sales prices of successive market operators in a vertical market. A cointegrated market is a market where price fluctuations are coordinated over a longer period of time, while in the short run price changes are erratic.

Gardner (1975) was the first to apply the price transmission coefficient to the food economy. Similar studies were conducted by Kinnuchan & Forker (1987) and Colman (1985). Palaskas (1995) examined whether perfect price transmission was conceivable. Von Cramon-Taubadel's 1998 approach has won many followers. In 2003 Rapsomanikis, Hallam & Conforti developed a method to demonstrate price transmission asymmetry and it is now widely used. In Hungary, studying price transmission in relation to cointegrated agricultural price time series has so far yielded directly utilisable results for the dairy and meat product chains. In 2004 S. Mészáros and P. A. Popovics conducted a methodology overview concerning dairy industry research. In the same vein P. A. Popovics and J. Tóth's 2006 paper

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reviews the study's findings on the asymmetry of price transmission in the dairy industry. J. Tóth's 2003 study on asymmetry draws on data analysing the Austrian meat industry. He partly conducted the study to make known Hungarian research methods. L.Z. Bakucs' 2005 study on the asymmetrical price transmission phenomenon also deals with various methodological issues.

1. Price transmission: research method and econometric foundations

There are several methodological groups regarding the study of vertical price transmission. Among the best known are the 'first differences' methods, 'the sums of first differences', 'error correction methods' and 'threshold methods'. Our studies are based on what is now the most widely used examination method, meaning the above-mentioned cointegration theory[2] and the error correction method (ECM), which originates from the former.

The vertical cointegration study is essentially a comparison between the price time series of two vertically related aggregated market operators in the product chain. The description of the relationship draws on information suggested by price trends and differences emerging from these trends of actual prices occurring at specific times. Therefore, this method is only suitable for time series managementcharacterised by stable and clearly definable statistical indicators. Our analysis is fundamentally limited to stationary processes, meaning processes that are 'stable over time' in the above sense of the word. This fact solidly endorses any new method capable of reducing this constraint through new methodological tools. The cointegration theory enables the study of time series which lack stability. Examining such time series is made possible by certain conversions in order to achieve their statistical stability.

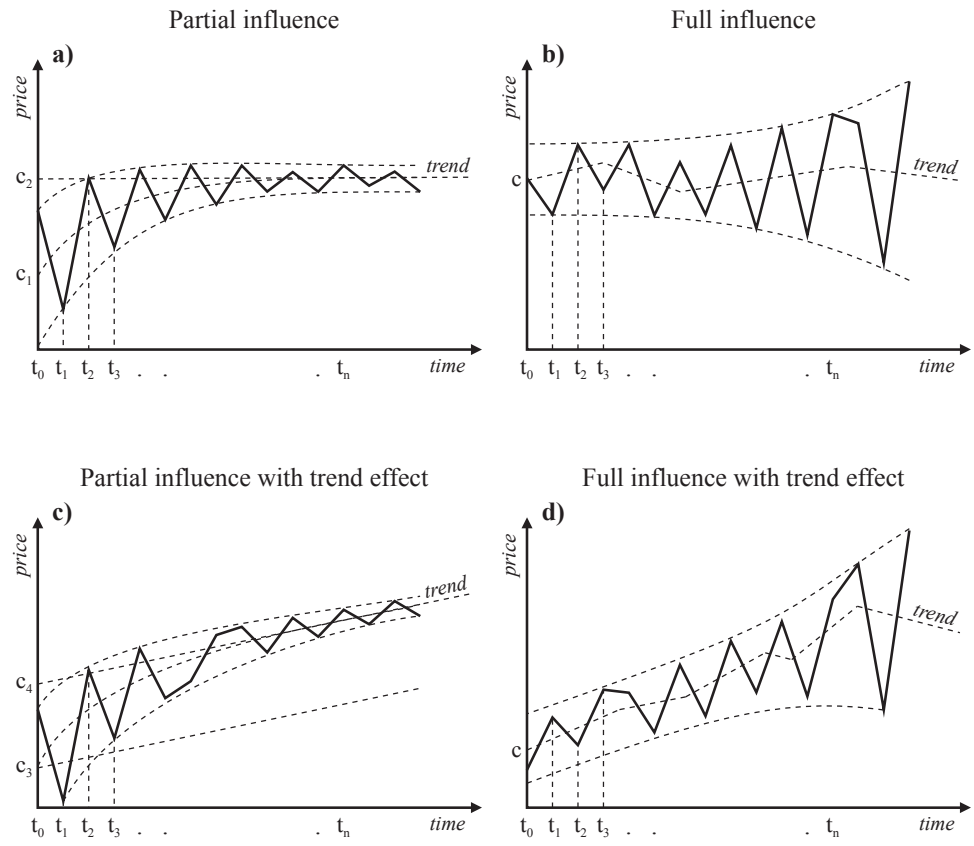
For time series essentially defined by their value at an earlier point in time, statistical instability is partly due to dispersion of the value pertaining to the earlier point in time which is added to the dispersion of the uncertainties (random effects) at the moment in question. The two dispersions reinforce each other at the observed moment with the result that, at that moment in time, the time series may receive its subsequent value from a scale considerably wider than before. As time progresses, it follows that this scale widens, which means that the probable values at consecutive time points become increasingly difficult to estimate. While the uncertainty caused by random effects (determinant factors that are not yet or cannot be quantified) cannot be reduced, the uncertainty pertaining to the preceding point in time's value is reducible.

The above-described situation occurs if the preceding point in time's value fully affects the value of the point in time under scrutiny. However, if the previous value only partially impacts (in the time series equation it is multiplied by a coefficient of a value below 1.0), its value will gradually decline (is reducible below any limit). Thus, it may occur that the time series values little by little approximate a threshold, around which they will only vary because of random effects. Figure 1.a shows this result. The time series initial trend, starting from the c_1 point, reaches the c_2 point upper threshold where it will only randomly vary.

[2] The method was invented by C. W. J. Granger, who was awarded the 2003 Nobel Prize in economics in acknowledgement of his achievements in the field, more specifically, for creating the economic term 'cointegration' and for developing the method suitable for the management of non-stationary time series.

Figure 1

The role of the value of the preceding period in the trend of the price time series



If the time series equation contains a trend factor, the value's effect from the preceding moment in time also decreases. Then the trend effect will continue to be exerted. The trend will subsequently shift from the c_3 starting point to the c_4 starting point (Figure 1.c).

Returning to the situation where the previous point in time's value fully influences the value of the time point in question, the time series trend must differ from the above scenario. The value of the previous point in time is transferred to the given point in time's value without any change. The former neither reduces nor increases the latter. Given that the expected (mean) value of the random effects is zero, the time series will not diverge from the initial value over a longer period. In the short term, however, the time series may adopt increasing values because the dispersion of values' band gradually widens. If no trend effect needs to be reckoned with (Figure 1.b), the possible joint movement of two time series of the above type can no longer be established with the required certainty because of the accumulation of the above-mentioned uncertainties. In such a time series equation, the preceding period coefficient is 1.0. Such equations are called equations **containing a unit root**. As in the equations of the above-described time series, this coefficient's value had to fall between -1.0 and 1.0, and are considered equations **without unit roots**.

While Figure 1.d also shows a time series with a unit root, it also contains trend effect. The increasing dispersion of values also complicates the determination of the trend direction. Beyond controlling the fluctuation of values, it is necessary to eliminate trend effects when comparing such price equations.

There are suitable tests for determining with sufficient certainty whether or not a unit root exists in a given time series[3].

As we have seen, a time series containing a unit root is not a stable time process. We have previously concluded that in connection with direct influence processes, with these type of processes the value of the point in time under scrutiny changes in the most straightforward manner. This depends on the value of the preceding point in time and a variable's value reflecting random effects. The respective equation is as follows:

$$y_t = y_{t-1} + v_1 \tag{1}$$

where: y_t is the value of the period under review
y_{t-1} is the value of the preceding period
v_t the variable of random effects at the time point in question and
t is the time index

At each point in time, the difference between the consecutive values, the increase of the time series, equals the random effects variable's value:

$$y_t - y_{t-1} = v_1 \tag{2}$$

Since the random variable's value varies around zero, its dispersion being constant, it is a stable time series in itself (v). If that is true, then the time series (Δy), derived from the difference between the time series consecutive values marked with y, i.e. the first differences of the time y series, must also be considered stable:

$$\Delta y_t = y_t - y_{t-1} = v_1 \tag{3}$$

In the above equations, the y_{t-1} factor's coefficient is 1.0 (which is therefore not marked). Thus equation (1) contains a unit root: for example, it is not stable. On the other hand, as stated above, equation (3) is stable. By generating its first differences, a non-stable time series has thus been converted into a stable one.

Granger (1981) stipulated that a non-stable time series is called a first-order integral and is marked with *I(1)* if its increment (the time series generated from the difference between its successive values) is stable. A time series, which is stable in itself, is called a zero-order integrated time series and is marked with *I(0)*.

Rephrasing our previous statement: by generating its first differences, a first-order integrated time series has been converted into a zero-order integrated time series.

If a pair of first-order integrated processes (e.g.: x_t and y_t) has a zero-order integrated combination (e.g.: $y_t = a \cdot x_t + v$), then the two time series are cointegrated. **The equation expressing the combination is the cointegration equation.**

[3] We have used the 'extended Dickey-Fuller-test' and the 'Phillips-Perron-test' as the tests most widely employed unit root tests.

It is possible to test the cointegration equation's existence for a pair of time series containing a unit root (cointegrated process), meaning the existence of cointegration. Suitable procedures are available to ensure the viability of testing methods[4].

Once the cointegrity of two price time series has been established and it is assumed that the two prices continuously and mutually affect each other[5], then a correlation can be established for one of the price's increments, in which it will depend on the increments of the other price at the moment in question and in the past as well including its own past increments. That correlation contains a long-term function for the relationship of the two prices (cointegration equation) and a short-term price-equalising function, which expresses the gradual recovery trend (correction) of the equilibrium price proportion upset by the sudden change of one of the prices (error). These relationships are described by the 'Error Correction Model' (ECM).

The ECM's short-term price restoration[6] block can be broken down separately to the sub-correlations of price increases and price decreases. This enables the rate of price increase and price decrease to be separately quantified. If these rates are different, the price effects are probably asymmetrical.

The cointegration equations enable us to determine the long-term purchase and sales prices of a vertical level. These are the prices in a permanent functional relationship with each other, expressing the technological relationship between the production factor and the finished product prices. **This price proportion expresses the correlation between the equilibrium purchase price and the equilibrium sales price between vertical local market operators. In this sense, these prices can be considered their own long-term local benchmark equilibrium prices.** In the error correction model, the benchmark equilibrium price of the purchase price $x = f(y)$ and the benchmark equilibrium of the sales price $y = f(x)$ can be defined, respectively, as the function of the sales price and the function of the purchase price. As for the actual movement of prices, any price increase and price decrease are always relative to these benchmark equilibrium prices. It is possible to define the values of the actual prices above and below the benchmark equilibrium price. **Similarly, it is possible to measure the degree of these price deviations (price surpluses or shortages) at certain time points and the frequency of price deviations during certain periods. Its value for the entire period under review gives an indication as to the existence and location of market power** (Figure 2). Subfigures a, b, c and d are indications as to the market power relations suggested by their respective headings.

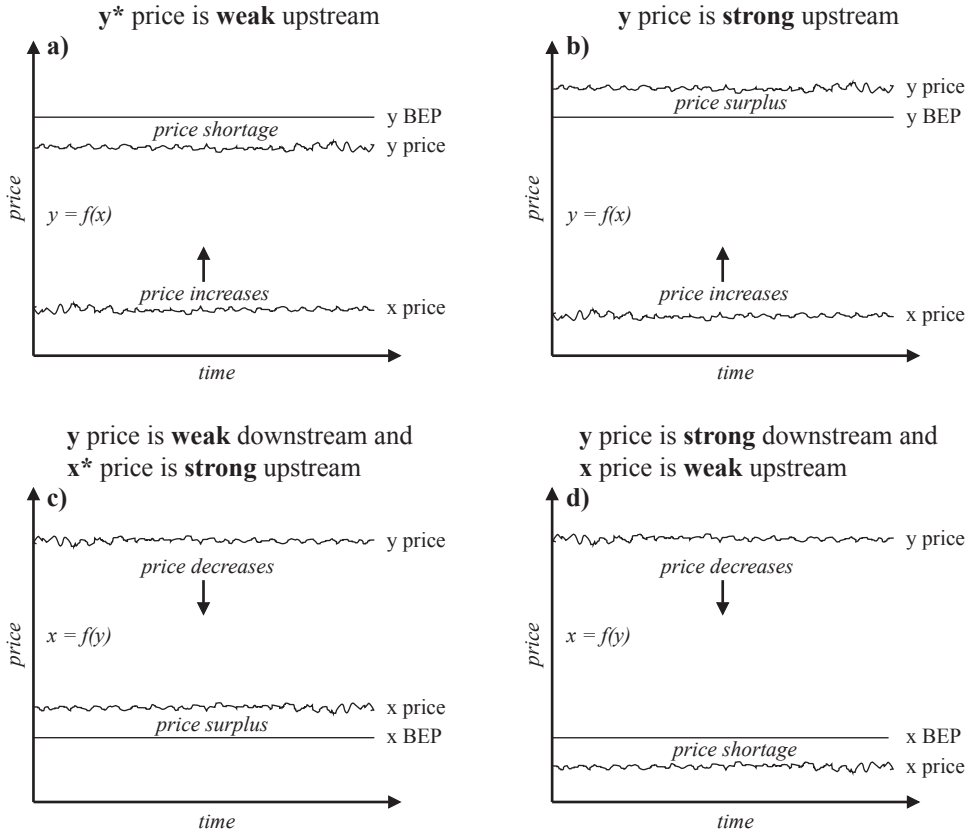
[4] Several methods exist for testing cointegration, e.g. the Durbin-Watson test, the extended Dickey – Fuller test or the Johansen cointegration test. We have used the Johansen cointegration test.

[5] The reciprocal effect of the two prices permits the disproportionate frequency and degree of effects of different direction. The assumption is useful even if in practice only one price, i.e. that of the dominant market operator exerts any influence on the other in the vast majority of cases, in the form of a shock-like price impulse (increase or drop). The disproportion is expressed by the value difference of the quantified effects.

[6] Price restoration = restoration of the original price relations

Figure 2

Market power relations as a function of the degree of price deviation from the benchmark equilibrium price (BEP)



* x = purchase price; y = sales price

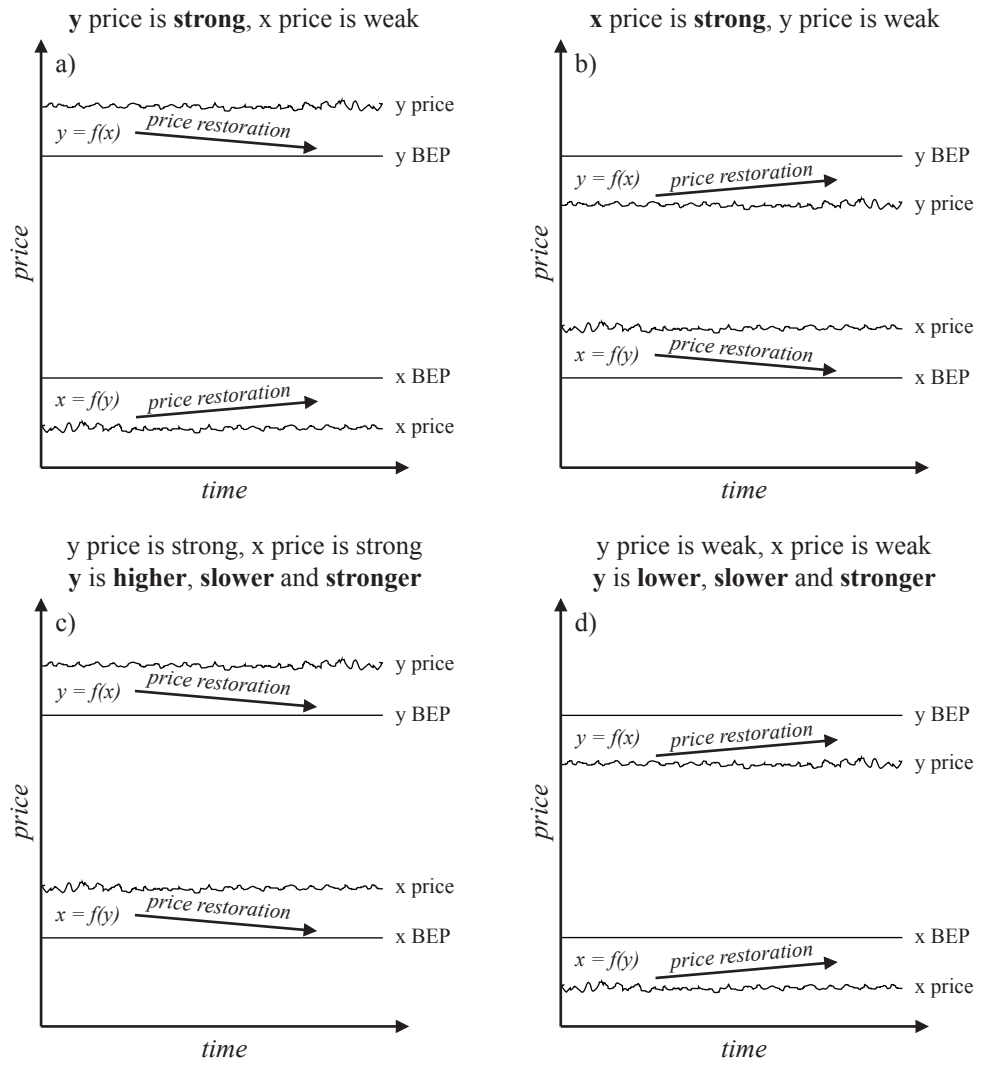
If, as a result of the rise of the purchase price, the sales price is typically below its benchmark equilibrium price, it follows that the seller is unable to pass on the increased price of his production factor, ie he does not possess market power, meaning he is 'weak upstream' (Figure 2.a). In the reverse situation, when he can maintain his sales price typically above its benchmark equilibrium, he is 'strong upstream' (Figure 2.b). This is only possible if one has market power. If the seller is forced to reduce his price and if, in such situations, the production factor seller is typically able to keep his sales price over its benchmark equilibrium, then, exercising his market power, the latter is 'strong upstream.' On the other hand, the product seller who can't pass on the price decrease to the production factor seller is 'weak downstream' (Figure 2.c). However, if the seller of the production factor is forced to reduce his price below its benchmark equilibrium for a long period, he is 'weak upstream', which means that market power resides with the seller of the product reducing his price, who is 'strong downstream' (Figure 2.d).

As previously mentioned, the error correction model also contains values for the restoration rate for the original price and the levelling of the margin which covers the

entire period. These values enable the calculation of the average restoration period. Again, its value indicates the existence and location of market power (Figure 3). Subfigures a, b, c and d are indications as to market power relations suggested by their respective headings.

Figure 3

Market power as the function of price restoration



As far as price restoration is concerned, both of the error correction model's equations model provide (different) values. If the recovering *y* (sales) price and the recovering *x* (purchase) price converge to their benchmark equilibriums respectively from above and from below, the seller of the product priced *y* is considered strong vis-à-vis the seller of the production factor priced *x* (Figure 3.a), as top-to-bottom price restoration indicates the weakening of an existing dominance. In the same vein, upward price recovery indicates faltering in terms of lack of dominance. Prompted by a similar consideration, in the reverse situation the seller

of the product priced *x* is considered strong vis-à-vis the seller of the production factor priced *y* (Figure 3.b). If both prices are being re-established from the top, market dominance is with the seller of the product whose price can be restored and thus surrenders the power position of its seller more slowly than the other, ie. the one with the higher recovery time factor, as the values are positive (Figure 3.c). In the event that both prices are being restored from the bottom up, market dominance resides with the seller of the product whose price is capable of being restored faster than the other, meaning the one with the higher recovery time factor, because these values are negative (Figure 3.d). In Figure 3.c and d, the direction of the arrow signifying price restoration is descends less sharply for the price *y*, which means there the recovery is slower so the owner of the product priced *y* is in the dominant position in both situations.

The equations describing mutual price determination, where the price *x* influence on price *y* and the influence of price *y* on price *x* are quantified, can include earlier values of both the influencing and the influenced prices. In economic terms, the inclusion of the latter in the model is justified, as a radical change in price's effects may be felt over a long period. The value of the coefficients in the equation may change depending on the number of variables assuming an earlier value, which are included in the model. In the model the equations' form may also change. They can also contain constant values and trend variables.

The selection of the equations best describing actual price relations (the specification of the equations) requires circumspection, reliance on statistical indicators and economic considerations. In order to be accurate, the model must be based on market links knowledge regarding the product chain and market operators' typical decision-making mechanisms. The general rules of logic also need to be taken into consideration. As for the latter, one must consider how easily one's conclusions on the whereabouts of the dominant market position can be nullified if, for example, one finds that a particular vertical-level *y* price is 'strong upstream', while the same price is found to be 'weak upstream' as a *x* price on the next vertical level. Such equation pairs must be considered to be erroneously specified even if they are cointegrated and are correct from an econometric point of view. They must be omitted from the scope of our study along with their vertical links. Similarly, the comparison of the price deviation and price restoration findings may also yield contradictory conclusions. Such price equation pairs and their links should also be disregarded.

The fact that a wide range of pros and cons must be considered before selecting which equations to use partly explains why we have not completely followed the most widely employed methodological rules of procedure (Rapsomanikis 2004). We have also chosen not to follow von Cramon-Taubadel's (1999) method. Instead we have opted to directly utilise the error correction model results, without separating its error correction block into price increases and price decreases.

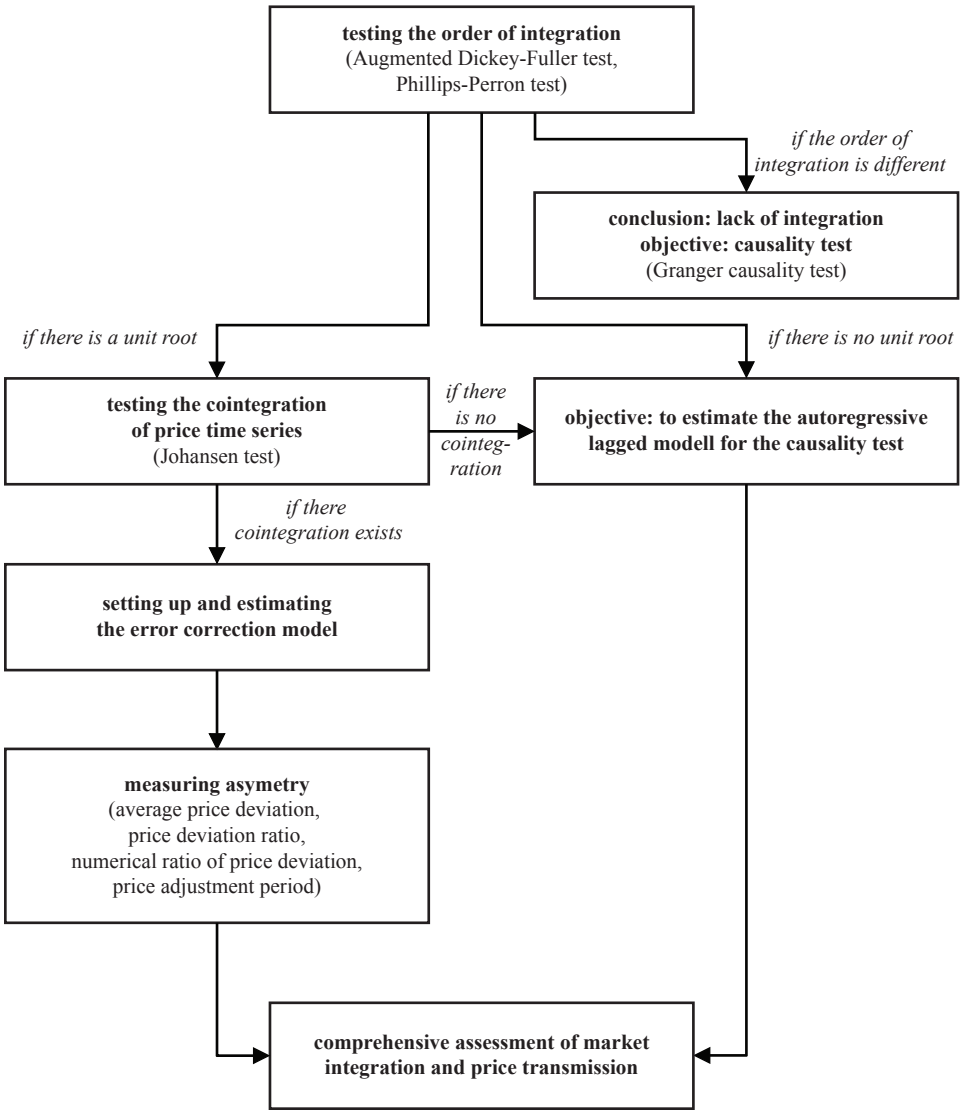
Based on the Granger causality test, the above series of procedures first establishes the 'influenced-influencer' relationship over the long term and performs the estimation by separating the error correction side of the so selected single increment equation to a price increase side and a price decrease side. For the price restoration rate the two sides will thus have a different coefficient value. The two coefficients will express, respectively, the transmission rate for price increases and the transmission rate for price decreases. An F-test then establishes whether the difference between the two is significant. Determining market dominance follows the logic that the dominant market operator seeks to decelerate the restoration

of price change consequences which are favourable to him and to accelerate those which are disadvantageous. According to this assumption, if the results reflect this condition, it also means that asymmetry causing market dominance lies with the market operator benefiting from the asymmetrical price change.

We have modified the above testing method by omitting the Granger causality test. This is because we wanted to determine the price effects' causality direction at a different point in the test. Therefore, we kept both equations of the error correction model (both the one that expresses price x influence on price y and the one expressing price y influence on price x). We did not separate the error correction sides into price increase and price decrease blocks. Instead, the two equations' price levelling coefficients are weighed against each other. We tested the ratio the price values determined by the cointegration equation yielding the 'benchmark equilibrium series' and they were above and below the benchmark equilibrium value during the entire period under review. In both equations this indicator takes on the same value Then we examined the values yielded by each equation for the price restoration rate. In the equations this indicator takes on a different value Market dominance is attributed to that market operator whose price remained more immune to the effect of the price changes. In other words, the market operator who can, over longer periods of time, achieve a value over his benchmark equilibrium price to a larger extent than a value below his benchmark equilibrium price. Furthermore, the market operator who could better delay the restoration of the price favourable to him while better accelerating the restoration of the unfavourable price. The situations shown in Figure 2 and Figure 3 illustrate the possible positions of vertical price relations and the power positions pertaining to the specific situations. Figure 4 shows our testing method, a modified version of Rapsomanikis' testing procedure.

Figure 4

Rapsomanikis' price transmission test, modified for the purposes of our study



Additional indicators were produced and analysed in order to achieve a more accurate description of the dominance relations. The following price **transmission indicators** have been employed:

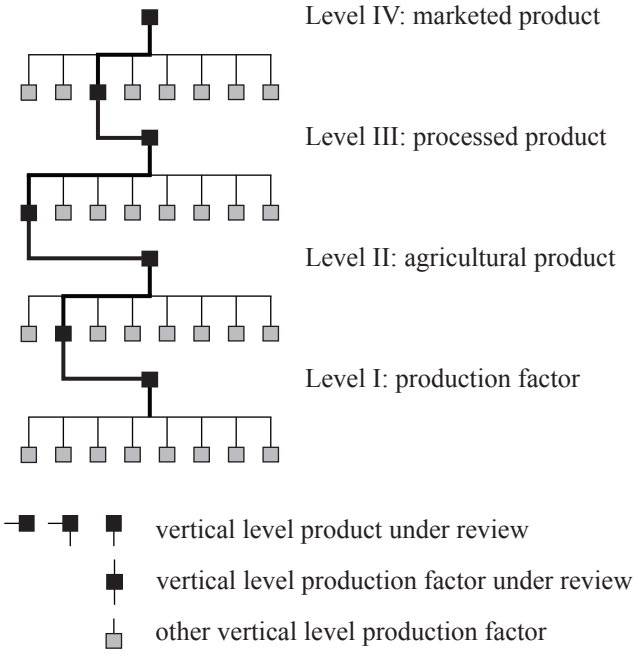
Price transmission indicators		
Description	**Content**	**Dimension**
price difference	The difference of the price surpluses and price shortages over the period under review.	HUF
average price deviation	The average price deviation (price surplus or price shortage) for the entire period.	HUF
price deviation ratio	Expresses the direction and degree of deviations exceeding 50 percent of the degree of the deviations from the benchmark equilibrium price. The positive and negative signs indicate the dominance of price surpluses and price shortages, respectively. Its numerical value expresses the ratio of the type of price deviation within the total price deviation.	%
frequency of price deviation	Expresses the numerical ratio of occurrence of the dominant price deviation (price surplus or price shortage) during the whole of the period.	%
price change ratio	The ratio between the average price deviation and the price	%
price deviation stability	The quotient of the price deviation ratio and the frequency of price deviation; range: *0.5 < price deviation stability < number of units in the time series*	a number without dimension
price restoration period	The period required for the margin to level off	months

2. The scope and database of the test

Vertical price transmission has been performed in 18 finished product chains for all of the producing and processing industries (the aggregated food sector). Other than the aggregated food product chain, the product chains were assembled by beginning with a finished product, and tracing the production route of one of its production factors until we reached an agricultural product's production factor. In that way, five vertical levels and two processed product levels (III a product level: the milling industry) and (III.b product level: the baking industry) were defined for marketed bread products. Other processed products and the aggregated food products were analysed on four levels and one processing level (III) (Figure 5).

Figure 5

The delimitation of products and levels in the vertical price transmission test



Each of the 18 levels of marketed products (IV) is based on its respective level of processed products (III , III.a and III.b). 8 levels of agricultural products (II) were analysed below the level of processed products. 4 different levels of production factors (I) are linked to agricultural products. The test was performed for the following product chains:

The product chains (marketed products) included in the price transmission test

	Aggregated food products
level IV	**Marketed food products, alcoholic beverages and tobacco**
level III	Processed food products, alcoholic beverages and tobacco
level II	Agricultural products
level I	Agricultural inputs

	Product chains (1-3)		
level IV	**white bread**	**Semi-white bread**	**Cottage-style loaf**
level III.b	Bread and fresh pasta	Bread and fresh pasta	Bread and fresh pasta
level III.a	Milling industry products	Milling industry products	Milling industry products
level II	Wheat	Wheat	Wheat
level I	Fertiliser active ingredients	Fertiliser active ingredients	Fertiliser active ingredients

	Product chains (4-6)		
level IV	**Sirloin**	**Pork chops**	**Leg of pork**
level III	Processed and preserved meats	Processed and preserved meats	Processed and preserved meats
level II	Slaughter cattle	Slaughter hog	Slaughter hog
level I	Mixed fodder for calves	Feed for fattening pigs (I. II. III.)	Feed for fattening pigs (I. II. III.)

	Product chains (7-10)			
level IV	**Bologna**	**'Olasz' salami**	**Processed ham**	**'Gyulai' sausage**
level III	Finished meat products	Finished meat products	Finished meat products	Finished meat products
level II	Slaughter hog	Slaughter hog	Slaughter hog	Slaughter hog
level I	Feed for fattening pigs (I. II. III.)	Feed for fattening pigs (I. II. III.)	Feed for fattening pigs (I. II. III.)	Feed for fattening pigs (I. II. III.)

	Product chains (11-13)		
level IV	**Broiler chicken**	**Pasteurised milk**	**'Trappista' cheese**
level III	Processed poultry products	Liquid milk	'Trappista' cheese
level II	Gallinaceous poultry for slaughter	Cow's milk, raw	Cow's milk, raw
level I	Broiler chicken feed (starter, grower, finisher)	Mixed fodder for cattle	Mixed fodder for cattle

	Product chains (14-16)		
level IV	**Granulated sugar**	**Cooking oil (sunflower-seed)**	**Dairy margarine**
level III	Processed sugar products	Vegetable and animal fats	Vegetable and animal fats
level II	Sugar-beet	Sunflower-seed (for oil production)	Sunflower-seed (for oil production)
level I	Fertiliser active ingredients	Fertiliser active ingredients	Fertiliser active ingredients

	Product chains (17-18)	
level IV	**White table wine**	**Red table wine**
level III	White table wine	Red table wine
level II	Wine-grapes and ungrafted vines	Wine-grapes and ungrafted vines
level I	Fungicides	Fungicides

The above vertical levels' monthly product price time series for the period January 2001 – December 2005 were used for our price transmission calculations. We drew on data from the Central Statistical Office (KSH) Information Database and the AKI Market Price Information System.

Vertical price transmission tests essentially require price data. However, certain indicators can also be calculated using the price indices from the seven indicators described in section 1. With the exception of the first two indicators which are expressed in monetary units, all the other indicators can be calculated from the price index lines. Price indices were used to generate the results of the aggregated food product chains.

Other than the price time series, food processing price indices are also recorded in the KSH Information Database. In cases where only a product's price index line was available (e.g. food processing), the price time series was generated from the price indices, i.e. by matching the latter to a minimum of three non-contiguous monthly price data obtained from other sources.

The tests were designed to define the relationships that can be most accurately described concerning the existence of cointegration. For that reason, no constants were used in these equations and we also made an effort to eliminate the effects of inflationary trends. Our price time series were deflated for that purpose. The application of our own price index would be the best method to eliminate inflation. That would, however, generate an invariable time series, unsuitable for further testing. Deflating while using the consumer price index would yield a variable time series, and the variance would also involve the input of elements unrelated to the price to be deflated, which would generate an undesirable distortion. Applying the product group's price near the product in question in terms of a deflating device would result in a similar situation. The core inflation indicator essentially considers inflationary elements influenced and controlled by the National Bank[7]. Certain factors such as basic food products and seasonal prices are disregarded. The price effects eliminated from the core inflation indicators are, however, essential for our tests. Consequently, if we use core inflation to deflate our prices, we deflate with that very factor (the basic inflation), from which we want to extricate our prices. In general, this occurs while not deflating with precisely those effects that we wish to examine, and thus which are preserved in our prices. For the above reasons, it suits our purposes that the core inflation indicator has been considered a suitable deflating device.

3. Test results and assessment

In vertical price transmission tests, particularly if there is no close normal correlation between the observed time series, the correct assessment of whether or not cointegration exists should be ensured by a 'filter system', which is best for minimising the risk of errors. This includes the test to establish the existence of the above-described unit root, the test to assess the existence of cointegration between the time series and the test to assess causality relation probability. In the error correction model where cointegration is quantified following the test performance to establish its existence at acceptable probability, the time series lagged values are also included as an influence factor. The cointegration relationship

[7] The core inflation indicator is calculated on the basis of the consumer price index. Under the agreement between the KSH and the National Bank (MNB), the methodology of the computation of the core inflation indicator is reviewed on an annual basis. As a result of the annual review, in addition to the items deleted previously from the consumer price index (non-processed foods, household energy and vehicle fuels, other seasonally priced products, pharmaceutical products subsidised by the Social Insurance Fund, services with a set official price and own-account housing services), lard, flour, groats and bacon were also dropped from the product list in 2003. The coverage of core inflation is thus 65.8%. It is calculated by the re-weighing of the index. The core inflation indicator is calculated on a base of December 1994 (MNB, 2006).

(the cointegration coefficient's degree) may also be dependent on the number of lags applied in the model. Therefore, the relevant methodology can also provide reference points concerning the optimal number of lags. In fact, the optimal number of lags is the one for which the value of the so-called Akaike information criterion or the Schwarz criterion is the lowest. However, as stated above, freedom from logical contradictions is a more important criterion. For example, if a market operator at an intermediate level in a product chain is considered upstream dominant in the market operator's downstream price relation, the market operator should also be upstream dominant in terms of price relation with the next highest level. We have therefore tested all possible lag versions (for the time series of 60 units, there are 16 in a single-direction relationship in each price pair). Without the versions containing a constant and a trend variable, which were disregarded for reasons stated above, there were 1,714 cointegration equation combinations. 16 possibilities were thus tested for the single-direction correlation of each price pair and the test priorities were considered for selection and approval of the least contradictory and best-fitting version and the assessment of the values. This was based on the correlation of the cointegration benchmark equilibrium series and the price series, among which the seven (or five, for price index series) price transmission indicators referred to above.

On the basis of the cointegration tests, lack of cointegration was established for only two price time series pairs. These two belonged to the processed and the marketed product levels of the sirloin and margarine product chains.

This high proportion of cointegrated price time series is not at all surprising if one considers first that vertical levels' purchase and sales prices must move in close correlation due to technological constraints (specific primary material requirements) and, second, the 16 equations per level provide a sufficiently safe opportunity for demonstrating cointegration where it exists.

Below, you will find an assessment of the findings for our price transmission tests on the cointegrated price pairs. These are are illustrated in Figure 1.

The resulting data in the **aggregated food product chain** confirm an opinion which has already gained credence among experts: agricultural production is undergoing dual price pressure. With a product chain approach, there is pressure from below, meaning production side factors and a different kind of pressure from above, meaning from processed product retailers, which is passed from the processors to agricultural producers.

The price transmission between the production factors' sales prices and an agricultural product's sales price has been found to be asymmetrical. During the observed period, 58.3 of the monthly observations (frequency of price deviation), production factors' prices were higher than the benchmark equilibrium of the respective production factors. During the same period, 56 percent of the differences from the benchmark equilibrium price were higher than the benchmark equilibrium price (price deviation ratio). In the five years under scrutiny, market dominance was with the market operator performing the production factor supply. This is confirmed because, on average, he was able to maintain his prices over his benchmark equilibrium price to a degree of 0.6 percent of that price during the period in question (price change ratio). This (not prominent) price surplus generated in the production factor supply was fairly evenly spread between the monthly prices. This is shown in the price deviation's stable value, which is close to 1 (0.96). However, during the reviewed period, the price

disparity caused by each price impulse (in our case, price decrease) is adjusted on average during a period of 80.4 months (price restoration period)[8].

The cointegration results between producer and processor levels have shown an asymmetry of 2.2 percent favouring the processor. In 65 percent of the observations and in 62.5 percent of the price deviations producer prices were below their respective benchmark equilibrium prices With a stability of 0.96 percent, price difference is considered to be balanced. The partners have accepted the cointegration of prices as an established practice. The restoration period of over two years (46.3 months) further indicates the series of incomplete price adjustments. In the light of the figures, the processors' market dominance vis-à-vis producers appears more pronounced than for production factors sellers.

The same producers, however, are bound to suffer a moderate dominance by retailers. In terms of the prices' percentage, their price shortage is below 0.1 percent. They were compelled to record a price shortage for 53.3 percent of the period, and their price shortage (price deviation ratio) was 51.7 percent. The price stability rate was 0.97. On average, prices were fully restored in 5.2 months. This information envisages unstable dominance by retailers, an interesting concept because, as we shall see regarding the major product chains' results, retail chains have an even more powerful market dominance. One should not forget, however, that the above result data concern the totality of food product chains, within which the individual product chains to be discussed below play an important if not exclusive role.

The only difference between the **three bread product chains** included in this study is the level of secondary processing. Any varying price movements are limited to bread products' different processors and retail prices

When investigating the product chain's lowest price pair, meaning the sales prices for fertiliser active ingredients and wheat, asymmetry favouring the production factor appears in the price transmission. The balance of the differences from the benchmark equilibrium price was a price surplus of HUF 39.9/month in the average of the five years under review. During the reviewed period the price surplus was, on average, 45.2 percent for fertiliser active ingredient prices. Such a price surplus degree. also implies that, in 88.3 percent of the monthly observations, the price for fertiliser active ingredients was above their benchmark equilibrium price. Price surplus accounted for 97.4 percent of all price differences, meaning the price was above its benchmark equilibrium price for a continued period of time. There was only one instance when fertiliser active ingredient sales were unable to take advantage and keep pace with the sudden increase of wheat prices, and this followed the drought in the second half of 2003. Throughout that 6-month period, their prices remained below their increased benchmark equilibrium price. The long-term price surplus also implied a stable price difference (1.1). The average price restoration period exceeded the five years under review (62.7 months).

At the next levels of the product chain, the price pair for wheat and milling industry products reveals primary processor market dominance. This particular asymmetry is reflected in the price of wheat remaining below its benchmark equilibrium price by HUF 1.6/kg over a five-year average. This 6.5 percent price shortage for the average price of wheat transpired in 73.3 percent of the months under review, accounting for 75.1 percent of all price differences.

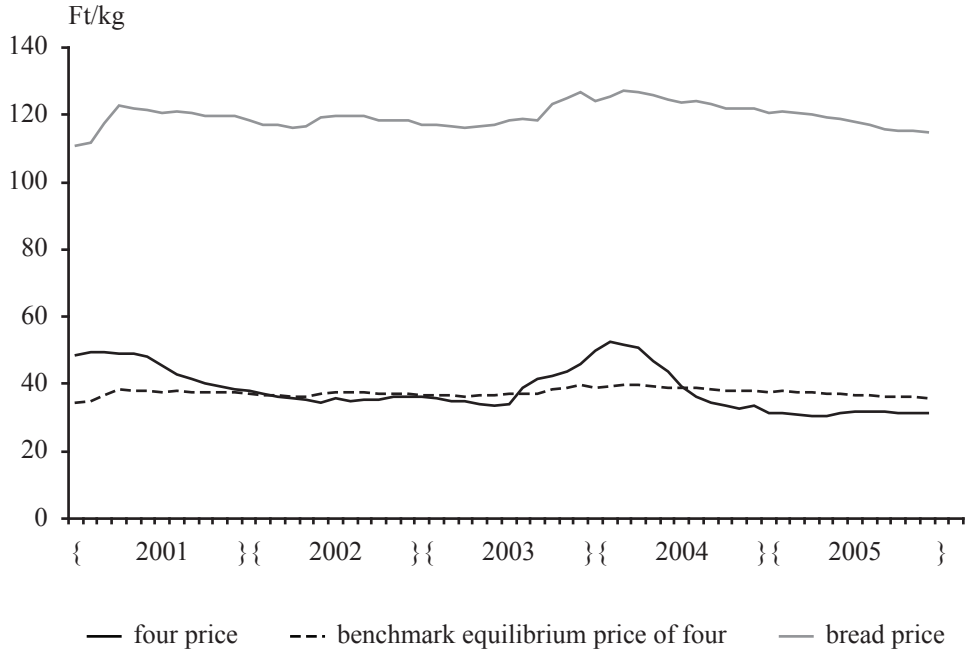
[8] Price restoration is a convergent process, in which the existing difference (residual difference) decreases into a constant direction in each interval (month). As the value of this ratio (cointegration coefficient) is lower than 1, the difference will never completely disappear. For our purposes, a price restoration of 99 percent was considered a complete one.

The price difference was stable (1.02). The long price restoration period (45.3 months) also confirms the milling industry's continued existence dominance.

The third identical price pair for bread product chains concerns milling industry products and the 'bread and fresh pasta' baking industry product group. At this point, our results appear to clash with most experts' opinions as to where market dominance lies, and the issue will now be discussed in more detail. Our calculations suggest that, in this market relation, market dominance lies with the milling industry. That average HUF 1 price surplus represents 2.8 percent in the price of flour. The price surplus month ratio is 43.3 percent. Price surplus accounts for 60.6 percent of the total price difference. Price deviation was not stable (1.4). Since price restoration would take almost 900 months, it is to be considered only a theoretical possibility. If this pattern of change for the price of flour and its benchmark equilibrium price are examined (Figure 6), it is found that there were two relatively long periods when the price of flour was significantly over its benchmark equilibrium price during the observed time frame.

Figure 6

Price transmission between the milling industry and the baking industry (2001-2005)



The first period entailed all of 2001, whereas the other, which followed the 2003 drought, lasted until July 2004. The results of our calculations for these two flour price surplus periods led us to conclude the existence of milling industry market dominance. Figure 6, however, shows that, during the last 18 months of the reviewed period, there was a positive though moderate flour price shortage. If our testing had been limited to these last 18 months, in all probability it would have revealed baking industry market dominance, since baking industry price decreases were able to force flour prices below the flour benchmark equilibrium price throughout that period.

Price transmission between bread production and bread retailing resulted in market dominance, which differed for the various products on the retail side. It represented a price shortage of HUF 0.7, HUF 0.5 and HUF 5.1 respectively in the processors' sales price for white bread, semi-white bread and cottage loaf. That price shortage respectively amounted to 0.6 percent, 0.4 percent and 4.1 percent of the actual prices. The ratio of price shortage months within the observed time frame was respectively 65 percent, 66.7 percent and 91.7 percent, whereas the price shortage within the total price difference was respectively 68.8 percent, 63.5 percent and 99.3 percent. With values around 1, the price difference was stable. For white bread, price restoration was around 0, meaning there was no major lag, meaning the processors' price virtually coincided with its benchmark equilibrium price. For semi-white bread and cottage loaf, price restoration would require 45 months and over two thousand months respectively.

Since we wanted to emphasise product differentiation in the price war between processing and retail, we changed tack and opted for assessment by indicator rather than by product. Our calculations have revealed the retailers' strategy: retailers stopped vying for a substantial price surplus on white and semi-white breads, striving to compensate for the loss of profit on cottage loaf.

The **sirloin product chain** is a slaughter cattle product chain. On the first level, the sale of mixed fodder for calves was established as the production factor. Slaughter cattle production became the next level. The price transmission between these two levels reveals producers' market dominance Consequently, those selling mix fodders experience a price shortage of HUF 13.1, which accounts for 22.4 percent of the price. In 95 percent of the observed months, price shortage occurred and accounted for 99.5 percent of the differences with the benchmark equilibrium price. That is another indication that price shortage remained stable. In fact, there is no price restoration (4,836.8 months). The trend during the last 18 months of the observed time frame showed a rise in the price for slaughter cattle and a decrease in prices for mixed fodder. In fact, these price movements meant that our calculation results leaned toward producer market dominance.

The price transmission between the price time series of slaughter cattle and processed and preserved meats led to processors market dominance. This dominance meant producers incurred a price shortage of HUF 30.2, which accounted for 13 percent of the per kilo price for slaughter cattle. The producers' price shortage occurred in 91.7 percent of the reviewed period, accounting for 96.7 percent of the total price difference. In the case of prices for slaughter cattle, no actual price restoration occurred either (4,054.6 months).

Due to the previously mentioned absence of cointegration, no price transmission could be computed between the processor level and the processed product retailer level. The price divergencies, however, clearly reveal market dominance at the retailer level.

Further on various aspects occurring in the pork production level and product chains will be discussed. These can be uniformly termed **slaughter hog product chains**. At the processor level, it includes two product groups, meaning processed and preserved meats and finished meat products. At the retailer level, the former group includes pork chop and leg of pork product chains. The finished meat products group includes bologna, 'olasz' salami, processed ham and 'Gyulai' sausage product chains.

The product chains' first level entails feed for pigs. The three feed types' weighted average price was deemed to be the price pertaining to the production factor level. At the producer level, the buying-in price for slaughter pigs represents the other part of the observed price pair Market dominance between the two levels was revealed to reside on the agricultural producer side. An average price shortage of HUF 6.2 can be established in the price for *fattening* pig feed. Compared to the average price of the feed, this price shortage represents 14.2 percent. A price shortage of 76.7 percent was seen during 76.7 percent of the months in the pertinent time period., accounting for 88.4 percent of the total price divergence from the benchmark equilibrium price. Moreover, weak positive stability (1.15) was observed in the price divergence among the feed types. There was no significant restoration in terms of the feed types' price movement (5,123 months).

Regarding price transmission at the successive vertical levels, the market dominance of slaughter pig production could be revealed vis-à-vis both meat processing and the production of finished meat products. Price transmission asymmetry is reflected in the data further down. Compared to the price of the processed and preserved meats and finished meat products, an average price surplus of, respectively, HUF 4.2 and HUF 3.5 was generated in the buying-in price for slaughter pigs. These represented 1.8 percent and 1.5 percent respectively in the price for slaughter pigs. Obviously, the same series of slaughter pig purchase prices was applied to both price pairs. The different results were due to the various price series for the two processed product groups. A higher market dominance by producers was revealed for raw meats, which have undergone a lower level of processing and therefore include a greater weight in terms of slaughtering activity. It therefore follows that producers are more dominant vis-à-vis slaughter-houses than vis-à-vis-the production of finished meat products. In other words, the value added during production can somewhat reduce producers' dominance. Incidentally, this particular dominance by producers was of a modest nature. This is confirmed by the price deviation indicators' values. Producers achieved a price surplus in less than half of the period under review: 41.7 percent and 36.7 percent respectively for processed and preserved meats and finished meat products. The price surplus included 58.6 percent of the price divergence for processed and preserved meats and 56.6 percent of the price divergence for finished meat products. Consequently, the price surplus was not stable throughout the entire period under review. The price deviation stability indicator of processed meats and meat products was 1.41 and 1.54 respectively. The price restoration period was 91.3 months and 75.7 months respectively for processed meats and finished meat products. As for monthly price movements, the high slaughter pig buying-in prices of 2001 represented the price surplus amplitude, which is expressed by the price deviation stability indicator. The fluctuation of buying-in prices remained essentially close to the price throughout the rest of the period.

Between levels three and four of the product chains, retailers had exclusive market dominance for processed meats, whereas for finished meat products it alternated between the two sides.

The price transmission for pork chops resulted in a price shortage of HUF 24.6 for those processing the product, which represented an average 5.5 percent of the price. Processors underwent a shortage of HUF 32.6 per kilogram on leg of pork. That shortage entailed 7.2 percent of their prices. For pork chops, a price shortage of 91.6 percent occurred during 76.7 percent of the period. The price shortage for leg of pork occurred during 80 percent of the period, accounting for 94.6 percent of the total price difference. The high numerical ratio (frequency of price deviation) and the equally high proportion (price deviation ratio)

for the price shortage indicates stable price deviation. For both price pairs, the period of full price restoration exceeds the observed five-year period (99.5 months and 93.3 months respectively).

As mentioned above, with the four finished product chains market dominance varied between the processor and retailer levels.. Processors generated a price shortage with trade prices for processed ham (average HUF 40.3; 9.6 percent of the price) and the 'olasz' salami (average HUF 7.2; 2 percent of the price). There was a minimal price surplus for 'Gyulai' sausage (HUF 0.9; 0.1 percent of the price). A higher price surplus was generated for bologna (HUF 13.3; 3.8 percent of the price). For processed ham and for 'olasz' salami, the price shortage was 99.7 percent in 90 percent of the five-year period and 86.6 percent in 80 percent of the period. For 'Gyulai' sausage and bologna, the price surplus was 51.3 percent in 50 percent of the observed time frame and 90.9 percent of the total price difference in 75 percent of this time frame. ,The price deviation was sufficiently stable enough for processed ham and the 'olasz' salami (1.11 and 1.08 respectively), and positively stable for the 'Gyulai' sausage (1.03). However, it was not stable for bologna (1.21). Price restoration is virtually absent for processed ham and the 'olasz' salami (4,913 and 4,087 months respectively), but it is complete in 49.5 and 19.9 months respectively for the 'Gyulai' sausage and bologna.

In the broiler chicken product chain, market dominance is systematically revealed at the upper level of each pair of levels.

At the first level of the product chain, the weighted average price for broiler feed (starter, grower and finisher) was considered the production factor price. At the second level, the sales price for gallinaceous poultry for slaughter was included in the first product chain price pair. Price transmission for the price pair resulted in an average price shortage of HUF 4.7 on broiler feed. In terms of the feed price, it represented 8.4 percent. The ratio of price shortage months was 91.7 percent. Price shortage accounted for 98.9 percent of all price deviations. Price deviation was considered stable (1.08). For broiler feed, price restoration was virtually absent. (2,729 months).

Price transmission asymmetry between sales prices for gallinaceous slaughter poultry and processed poultry meat transpired as a price shortage of HUF 20.9 for gallinaceous slaughter poultry, which encompassed 11.9 percent of the gallinaceous slaughter poultry sales price. The price fell below the benchmark equilibrium price for 91.7 percent of the observed time frame, which totalled 98.9 percent of all price deviations. Price deviation was considered stable (1.08). No price restoration cropped up for the gallinaceous slaughter poultry price (2,729 months).

When it came to the price pair for processed and sold poultry meat, the processor incurred a price shortage. The price shortage entailed HUF 5.6, 2 percent of the price. Price shortage transpired in 70 percent of the months in the given period, in 81.9 percent of all price deviations. Price restoration is a non-factor for the processed poultry price (3,909 months).

With **dairy product chains it is more** complicated to determine market dominance than with poultry products. Mixed fodder marketers are clearly dominant vis-à-vis raw milk producers and clearly the retail trade is dominant in relation to processors. On the other hand, when it comes to those producing and processing liquid milk, producers are the dominant party. However, with 'Trappista' cheese it is the opposite and processors dominate. During the observed period between 2001 to 2005, the buying-in price for raw milk typically hovered around HUF 70 per litre, and this lasted until January 2004, after which it dropped by

about HUF 10 and then remained at that level. With liquid milk, the raw milk price remained above its benchmark equilibrium price until 2004. In response the price transmission study evaluated producers as market operators who can resist long-term price pressure from producers, meaning they are considered as the dominant party. The price of Trappista cheese is only moderately linked to fluctuations in the raw milk price. This can be partly explained by its higher added value content. This issue is dealt with in more detail in the section on the in-depth interviews. Given the processors' 'Trappista' cheese price of HUF 800-1,000/litre, the HUF 10/litre raw milk price decrease falls below that required to alter the otherwise unstable position of market dominance. Therefore, the 'Trappista' cheese market dominance was considered to reside with the processors.

In the dairy product chains, prices for mixed cattle fodder include a price surplus of HUF 3.5 compared to producers' prices for raw milk, which entail 7.4 percent of the mixed fodder price. A price surplus transpired during 70 percent of the given time period with a ratio of 72.9 percent compared to all price deviations. The distribution of price deviations was stable throughout the period (1.04). During the given time frame the price deviation is not equilibrated (90.2 month).

In the price transmission between the producers' sales prices for raw milk and processed liquid milk, an average price surplus of HUF 4.7 appears for raw milk. This price surplus represents 8.7 percent of the raw milk price. Price surplus occurred in 68.3 percent of the months under review, and entailed 87.5 percent of all price deviations. There was considerable fluctuation in price deviations. The high price surplus period extending to 2004 was followed by a low price shortage period. The price deviation stability indicator was 1.28. At 2,365 months, the price restoration rate was negligible.

For the price pair of raw milk and 'Trappista' block cheese, an average price surplus of HUF 23.7 appeared for the cheese. This 3.1 percent price surplus of 3.1 percent happened in 75 percent of the reviewed five-year period, accounting for 76.4 percent of all price deviations. For the entire period, price deviation was stable, with the price restorations transpiring in an average of 16.5 months.

The price transmission between processors and retailers resulted in a price surplus for the retail trade. This was indicated by a HUF 0.7 per litre price shortage in the processors' price for liquid milk and the HUF 7 per kilogram price shortage in the processors' price for 'Trappista' cheese. The price shortage for liquid milk and cheese came to, respectively, 0.8 percent and 0.9 percent of the price. The price shortage for liquid milk was apparent in 55 percent of the period under review, accounting for 68.1 percent of all price deviations. However, for cheese, the price shortage period was only 48.3 percent, in 63 percent of all price deviations. Price deviation varied throughout the period. For liquid milk, in 2002 and 2003 price shortage appeared as a lasting downturn, which was preceded and followed by smaller waves of surpluses and shortages (1.24). The price fluctuation of cheese was characterised by shorter and wider amplitudes in both directions (1.3). No price restoration was apparent for liquid milk (3,370 months). For 'Trappista' cheese, however, the restoration process was completed in an average of 15.6 months.

For the **granulated sugar** product chain our calculations indicated that both the sellers of fertiliser active ingredients and sugar processors are in a dominant position vis-à-vis sugar beet producers. Retail trade is in a dominant position within the market relationship between processors and retailers.

During the observed time frame, a price surplus of HUF 17.5 per kilogram was achieved in the fertiliser active ingredient price, which entailed 15.8 percent of the price. This price surplus occurred during 75 percent of the period, accounting for 89.5 percent of total price divergence. There were radical price deviations . During the 2001-2002 period a high price surplus for fertiliser active ingredients occurred. In 2005 there was also a considerable price surplus when the buying-in price for sugar beet was low. The price deviation stability indicator was 1.19. Price restorations were completed within a month.

Price transmission between sugar beet production and processing generated an average price shortage of HUF 0.3/kilogram by producers during the period 2001 to 2005. This price shortage, representing 4.1 percent of the buying-in price for sugar beet, occurred during 58.3 percent of the period. Within the total price deviation, price shortage accounted for 64.4 percent. While the price deviation was stable (1.1), the low 2005 buying-in prices represented a minor amplitude. Price restoration could not be completed for the buying-in prices of sugar beet (2,771 months).

Testing the pair for trade price processed sugar and retail price granulated sugar revealed an average price shortage of HUF 0.6 of processors' sales price. This shortage represented 0.4 percent of the price. Price shortage was detected for 50 percent of the reviewed months. The price shortage ratio within all price deviations was 59.5 percent. Throughout the first half of the five-year period, price deviation remained very stable. While prices began to fluctuate slightly during the second half of the period, they were still essentially below the benchmark equilibrium price. The indicator's 1.19 value indicates that decreasing stability.

As with the broiler chicken product chain, market dominance in the **sunflower seed based** cooking oil and margarine product chains always resides at the higher level between each level pair.

The price transmission for the production factor and the agricultural product yielded an average price shortage for the former of HUF 0.4 in the sales price per kilogram of fertiliser active ingredients. That price shortage of 0.3 percent of the price of active ingredients occurred in 48.3 percent of the five-year period, accounting for 51.3 percent of all price deviations. The price deviation stability indicator was 1.6, meaning market dominance was extremely unstable in the product prices relationships, which is also shown in the minimal (1.3 percent) price shortage for the production factor. Price restoration rate was very low between two points in time (months). The time required for a complete restoration is 180 months.

In the price relationship for the agricultural product and the processed product, the sunflower-seed sales price suffers a price shortage vis-à-vis the vegetable oil sales price. The price shortage is HUF 4.4 per litre. That is 8.3 percent of the sunflower seed price. The price shortage occurred in 90 percent of the period, accounting for 94.8 percent of the total price difference. On average, prices were fully restored in 39 months.

As discussed above, for margarine a non-cointegrated price transmission took place between diverging price time series, ensuring a price surplus devoid of price restoration potential (i.e. dominance) for the retailer of the processed product over the processor.

Price transmission in the **wine product chains** resulted in a dominant position for the vertical partners both below and above the producer level. For white table wines, the

processor level was exposed to price pressure from retailers of the processed product, while processors were dominant over retailers when it came to red table wines .

A price surplus of HUF 84.5 per kilogram was achieved in the price for fungicides chosen as the production factor, which represented 4.1 percent of the price. This price surplus occurred in 56.7 percent of the five-year period, amounting to 60.6 percent of all price divergence. The fluctuation of fungicide prices was characterised by an acceptable level of price deviation stability and a restoration period of less than 20 months.

The relationship between the sales price of wine-grapes and the processors' price of white table wine is clearly expressed by the HUF 1.6 price shortage of the price of wine-grapes. That price shortage which composed 3.2 percent of the price of grapes, occurred in 56.7 percent of the studied months, representing 59 percent of total price deviations. Price deviation was stable (1.04), and prices were restored within 15 months. The same price relationship also created the price shortage of wine-grapes in the processors' price of red table wines. Here, price shortage amounted to HUF 1.2, which entailed 2.6 percent of the price of grapes. The ratio of price shortage months was 56.7 percent, while the price shortage ratio and the price deviation stability were respectively 57.1 percent and 1.01. On average, prices were restored in 15.6 months.

For white table wines there was a price shortage of HUF 3.7 in the processors' sales price, which totalled 3.7 percent of the price. In 91.7 percent of the period under review price shortage was observed. The ratio of price shortage within all price deviations was 99.2 percent. Price deviation was considered stable (1.08). Full price restoration would have required 538 months. However, a price surplus of HUF 0.6 materialized for the price of red table wines. That price surplus which came to 0.6 percent of the price happened in 60 percent of the pertinent five-year time frame. The proportion of values over the benchmark equilibrium price was 69 percent. Price deviation was somewhat unstable. Moreover, frequent modest price fluctuations could easily overturn existing market dominance positions.

What is most noteworthy about the results of the product-level price transmission tests are the **great product-to-product differences in industry-level market dominance**. For some products neither party is in a dominant position. For example, let us take the finished product processor level in the pork product chains. There market dominance was apparent for pork chops, leg of pork, 'olasz' salami and processed ham, but no dominance was apparent for bologna and 'Gyulai' sausage. When one views all products, one presumes that retail trade is in a dominant position and calculates a tactical price shortage on certain products, which it subsequently compensates for with other prices, which are not necessarily food products.

Another observation that could alter the stereotypical view regarding market dominance is that **some of the actual dominant market positions are unstable, meaning they could easily tip in favour of the vertical partner level**. This phenomenon could be observed for market dominance where price deviations were just slightly over 50 percent in either direction. This also applies to market dominance between the processor and retailer levels of the food product chains, which currently tip in favour of the retail trade. In the product chains the same phenomenon was observed regarding the advantage enjoyed by the 'Gyulai' sausage retailer level and regarding the advantage enjoyed by sunflower seed producers vis-à-vis the sellers of fertiliser active ingredients.

Weather related price fluctuations parallel with the relationship between prices and yields can also affect prices to the point of creating **shifts in market dominance**. Following the drought of 2003 there was a prolonged rise in wheat prices. Although this price rise was unable to convert the price pressure of fertiliser active ingredients into market dominance, it was sufficient to generate a ripple effect in the price of flour, which has brought about the dominance of mills over the baking industry.

The results of price transmission tests have confirmed that **the emergence of stable market dominance is not specific to either product chains or vertical levels**. In the various product chains, the dominance of retail trade may range between 59 and 99 percent. The average 51.7 percent price surplus at the retail level in the aggregated food product chain is especially remarkable.

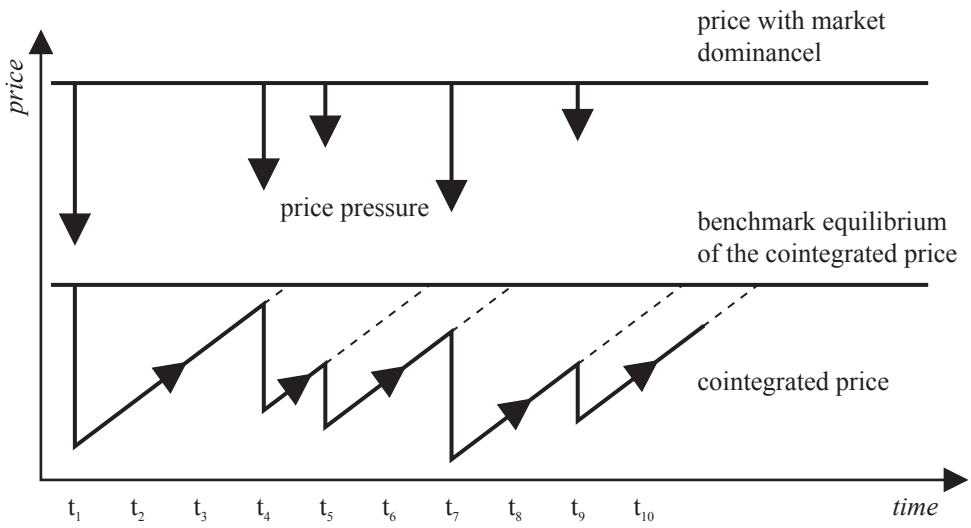
The test results provide insight into how this kind of vertical integration keeps producers' interests at heart. The Alföldtej operation's first results are already apparent. Rather than increasing buying-up prices, **assertion of producers' interests** has initially resulted in the **normalisation and stabilisation of market relations and contract terms and** conditions, all of which will be further discussed below. At a later phase in this economic power struggle price achievements are expected to appear.

The test results have also shed light on the cointegration price restoration process. Other than for 10 out of the 58 vertical market relations, it was determined that **there was no genuine potential for full price restoration during the observed (five-year) time frame.**

Our test method was based on the cointegrative simultaneous movement of prices. It permits short-term divergence of prices within certain boundaries, provided that the distance between the cointegrated prices (benchmark equilibrium series) is restored according to a specific (in our case, definable) restoration coefficient. The price transmission calculations treat restoration as a mathematical possibility, without considering its actual probability. That is why the results show that the restoration cycle can exceed the length of the period under review.. The person adopting the procedure is supposed to consider price restoration's actual reality.. Otherwise stated, if the price restoration cycle exceeds the reviewed time period, it indicates lack of restoration and cointegration. If the restoration period is shown to be within the period yet remains incomplete, failing to reach an equilibrium, it indicates a non-perceptible value leakage. (Figure 7). **The dominant market operator can decelerate his own prices' beneficial change so that the next price change cycle starts before the previous one has ended.** Just like a good volleyball team whose well-timed shots stop the ball from hitting the floor.

Figure 7

A leakage of value reflected in terms of price relations' imperfect restoration



With agricultural pricing, imperfect price restoration may explain a decades-long gradual divergence of a product's market price from the Walrasian equilibrium price, meaning its presumed but indefinable inherent notional value. A hypothetical perfect market's equilibrium prices had been shaped by the existing oligopolistic/oligopsonic price diverting mechanisms. This was done so the equilibrium prices of the oligopolistic/oligopsonic market were accepted by the market operators instead of the market prices in proportion with notional values. These imply the possibility of value leakage, which occurs without being perceived by the (in our case, agricultural) market operators with opposing interests since, over the long run, they tend to lose sight of the benchmark equilibrium price, which in the market helps them find their way. Instead their price calculations will be based on previous prices and the prices from familiar local markets. Market power equilibrium stemming from supply and demand is supposed to ensure the full restoration of prices. Agricultural producers prefer visible yet unpredictable deterioration of price values over its alternative, meaning concentration which threatens their livelihood. Instead, they tend to compensate for this long-term value leakage which undermines their income with other activities or from grants.

In the prices accepted (their own benchmark equilibrium price), price-follower market operators will also absorb price-setting value leakage, thus sacrificing further parts of their income and grants. As a result, the original value (notional price, perfect market price) is no longer traceable and will cease to operate as a benchmark equilibrium price.

4. Discussion

As mentioned in the introduction, price transmission studies have been published in Hungary for the pork product chain (Bakucs L.Z., 2005) and the dairy product chain (Popovics P.A. - Tóth J., 2006). Based on von Cramon-Taubadel's method, these studies examined asymmetry in the rate and the extent of price increases and decreases (VECM) in order to establish the existence of market dominance with one of the opposing market operators. Our research method does the same, drawing on indicator values which are based on the price surpluses' degrees and shortages compared to the cointegration equation as the benchmark equilibrium price. Our research differs from the above tests which employed the Granger causality test to determine the market's dominant side. Instead we used the actual price surplus compared to the average cointegration equation's price to locate market dominance.

The meat product chains study first analyses a ten-year time series, then contends that a structural break occurred. After the meat product chain study divides it into two sections, each of which is then analysed separately. We examined a five-year period with the assumption there were no breaks in the economic policy. While the meat product chains study was based on two aggregated pork prices, our calculations were based on six trade product prices along the same product chains. Despite the above differences in concept and time horizon, both the von Cramon-Taubadel method and the method adopted by us revealed cointegration between the prices of pork product chains. Our study covered more commercial products and managed to display more details concerning market dominance.

The paper analysing dairy price product chains price transmission is based on monthly price data over an eight-year period, which breaks down into two separate periods. It uses the Akaike and the Schwarz information criteria for determining the optimum number of lags. Thus no lag is taken into consideration for the unit root test, whereas two lags are applied for the Autoregressive Distributed Lag model. The latter is employed because no cointegration was found by the unit root test. For logical reasons out of sixteen lags we selected the optimum number of lags. No statistical tests were applied. In light of our previously mentioned results, the ADL model and our cointegration equations yielded similar results for market dominance directions. This was despite the above-mentioned differences in approach.

Annex 1

Result indicators for the price transmission calculation within food product chains

product	number of lags	price deviation (HUF)	average price deviation (HUF)	price change ratio (%)	frequency of price deviation (%)	price deviation ratio (%)	price deviation stability (without dimensions)	restoration period (months)
aggregated foods Pc_Rt	14	-1,129.8	-18.8	0.0	-53.3	-51.7	0.97	5.2
aggregated foods Pd_Pc	12	-60,032.2	-1,000.5	-2.2	-65.0	-62.6	0.96	46.3
aggregated foods Ex_Pd	3	32,805.7	546.8	0.6	58.3	56.0	0.96	-80.4
cottage loaf P2_Rt	2	-304.9	-5.1	-4.1	-91.7	-99.3	1.08	-2,345.8
cottage loaf P1_P2	5	62.6	1.0	2.8	43.3	60.6	1.40	895.9
cottage loaf Pd_P1	15	-94.6	-1.6	-6.3	-73.3	-74.4	1.02	20.4
cottage loaf Ex_Pd	14	2,394.3	39.9	45.2	88.3	97.4	1.10	-62.7
semi-white bread P2_Rt	4	-27.6	-0.5	-0.4	-66.7	-63.5	0.95	-44.9
semi-white bread P1_P2	5	62.6	1.0	2.8	43.3	60.6	1.40	895.9
semi-white bread Pd_P1	15	-94.6	-1.6	-6.3	-73.3	-74.4	1.02	20.4
semi-white bread Ex_Pd	14	2,394.3	39.9	45.2	88.3	97.4	1.10	-62.7
white bread P2_Rt	15	-40.8	-0.7	-0.6	-65.0	-68.8	1.06	0.0
white bread P1_P2	5	62.6	1.0	2.8	43.3	60.6	1.40	895.9
white bread Pd_P1	10	-97.9	-1.6	-6.5	-73.3	-75.1	1.02	45.3
white bread Ex_Pd	14	2,394.3	39.9	45.2	88.3	97.4	1.10	-62.7
sirloin Pd_Pc	6	-1,814.7	-30.2	-13.0	-91.7	-96.7	1.05	4,054.6
sirloin Ex_Pd	7	-785.9	-13.1	-22.4	-95.0	-99.5	1.05	-4,836.8
pork chops Pc_Rt	14	-1,474.4	-24.6	-5.5	-76.7	-91.6	1.19	93.3
pork chops Pd_Pc	1	252.4	4.2	1.8	41.7	58.6	1.41	91.3
pork chops Ex_Pd	10	-369.5	-6.2	-14.2	-76.7	-88.4	1.15	-5,123.3

product	number of lags	price deviation (HUF)	average price deviation (HUF)	price change ratio (%)	frequency of price deviation (%)	price deviation ratio (%)	price deviation stability (without dimensions)	restoration period (months)
leg of pork Pc_Rt	14	-1,955.1	-32.6	-7.2	-80.0	-94.6	1.18	99.5
leg of pork Pd_Pc	1	252.4	4.2	1.8	41.7	58.6	1.41	91.3
leg of pork Ex_Pd	10	-369.5	-6.2	-14.2	-76.7	-88.4	1.15	-5,123.3
bologna Pc_Rt	2	796.9	13.3	3.8	75.0	90.9	1.21	2,719.9
bologna Pd_Pc	1	209.8	3.5	1.5	36.7	56.6	1.54	75.7
bologna Ex_Pd	10	-369.5	-6.2	-14.2	-76.7	-88.4	1.15	-5,123.3
‘olasz’ Pc_Rt	8	-433.9	-7.2	-2.0	-80.0	-86.6	1.08	4,086.7
‘olasz’ Pd_Pc	1	209.8	3.5	1.5	36.7	56.6	1.54	75.7
‘olasz’ Ex_Pd	10	-369.5	-6.2	-14.2	-76.7	-88.4	1.15	-5,123.3
processed ham Pc_Rt	13	-2,415.8	-40.3	-9.6	-90.0	-99.7	1.11	-4,913.9
processed ham Pd_Pc	1	209.8	3.5	1.5	36.7	56.6	1.54	75.7
processed ham Ex_Pd	10	-369.5	-6.2	-14.2	-76.7	-88.4	1.15	-5,123.3
‘Gyulai’ Pc_Rt	8	56.4	0.9	0.1	50.0	51.3	1.03	49.5
‘Gyulai’ Pd_Pc	1	209.8	3.5	1.5	36.7	56.6	1.54	3,318.1
‘Gyulai’ Ex_Pd	10	-369.5	-6.2	-14.2	-76.7	-88.4	1.15	-5,123.3
broiler chicken Pc_Rt	5	-333.4	-5.6	-2.0	-70.0	-81.9	1.17	3,908.9
broiler chicken Pd_Pc	12	-1,256.0	-20.9	-11.9	-91.7	-98.6	1.08	-3,181.6
broiler chicken Ex_Pd	1	-282.2	-4.7	-8.4	-91.7	-98.9	1.08	-2,728.8
liquid milk Pc_Rt *	2	-43.0	-0.7	-0.8	-55.0	-68.1	1.24	3,369.5
liquid milk Pd_Pc	1	284.9	4.7	8.7	68.3	87.5	1.28	2,365.4
liquid milk Ex_Pd	8	207.5	3.5	7.4	70.0	72.9	1.04	90.2
‘Trappista’ cheese Pc_Rt	1	-421.7	-7.0	-0.9	-48.3	-63.0	1.30	15.6

product	number of lags	price deviation (HUF)	average price deviation (HUF)	price change ratio (%)	frequency of price deviation (%)	price deviation ratio (%)	price deviation stability (without dimensions)	restoration period (months)
‘Trappista’ cheese Pc_Pd	7	1,420.8	23.7	3.1	75.0	76.4	1.02	-16.5
‘Trappista’ cheese Ex_Pd	8	207.5	3.5	7.4	70.0	72.9	1.04	90.2
granulated sugar Pc_Rt	1	-33.1	-0.6	-0.4	-50.0	-59.5	1.19	43.8
granulated sugar Pd_Pc	8	-18.4	-0.3	-4.1	-58.3	-64.4	1.10	2,771.1
granulated sugar Ex_Pd	15	1,050.8	17.5	15.8	75.0	89.5	1.19	0.0
cooking oil Pc_Rt	15	-270.0	-4.5	-2.3	-80.0	-79.2	0.99	96.5
cooking oil Pd_Pc	15	-266.8	-4.4	-8.3	-90.0	-94.8	1.05	39.1
cooking oil Ex_Pd	2	-25.6	-0.4	-0.3	-48.3	-51.3	1.06	179.8
margarine Pd_Pc	15	-266.8	-4.4	-8.3	-90.0	-94.8	1.05	39.1
margarine Ex_Pd	2	-25.6	-0.4	-0.3	-48.3	-51.3	1.06	179.8
white table wine Pc_Rt	15	-223.1	-3.7	-3.7	-91.7	-99.2	1.08	537.8
white table wine Pd_Pc	6	-94.3	-1.6	-3.2	-56.7	-59.0	1.04	14.9
white table wine Ex_Pd	5	5,070.8	84.5	4.1	56.7	60.6	1.07	-19.9
red table wine Pc_Rt	4	33.7	0.6	0.6	60.0	69.0	1.15	-4,499.9
red table wine Pd_Pc	6	-74.1	-1.2	-2.6	-56.7	-57.1	1.01	15.6
red table wine Ex_Pd	5	5,070.8	84.5	4.1	56.7	60.6	1.07	-19.9

* Rt: retail trade
Ps: processing industry
P1: milling industry
P2: baking industry
Pd: production
Ex: production factor

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