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AGRICULTURAL PRODUCTS NOTED ON COMMODITIES EXCHANGE
AND GLOBAL FINANCIAL CRISIS

PRODUKTY ROLNE NOTOWANE NA GIEŁDACH TOWAROWYCH
A GLOBALNY KRYZYS FIANASOWY

Key words: grain, futures, biofuel, technical analysis, price

Słowa kluczowe: zboża, przyszłość, biopaliwa, analiza techniczna, ceny

Abstract. The trade of agricultural products on commodity exchange and the prices at the exchange are controlled by specific inner regularities. The prices are considerably affected by the cyclicity of production, the annual yield fluctuation by countries (internal market) and world production (world market), as well as the demand for products. The prices are partly independent from other commodity exchange products. The paper analyses the forward deals (by exchange technical analysis and statistical methods) in the grain section of the Budapest Stock Exchange in Hungary in order to prove that the commodity exchange products, too, could not temporarily be kept away from the impact of financial crisis which started in summer 2008. Temporarily, the stock exchange processes pulled the grain market prices down, which badly influenced the income and receipts positions, but made a price correction in the fodder maize and fodder wheat prices which slipped out of control in 2007. This latter fact made the position of livestock farmers more favourable.

Introduction

The deals with agricultural products have a special place among commodity exchange products. Most of these deals are hedge deals on the futures market. The Central Eastern European commodity exchange markets are relatively underdeveloped with low turnover compared to some well-known big commodity exchanges (e.g. Chicago Board of Trade (CBOT)).

The prices of agricultural products show some cyclicity involving the following factors: cyclicity of production, yield fluctuation, yield expectations and demand. According to a comparative analysis on Hungarian and international aspects covering several years [BÁCS 2003], the mean price sequences of spot markets and future markets show a slightly increasing tendency within the production cycle and the degree of their parallel shift was primarily influenced by the yields of the production year. The consumer expectations have also determining influence on prices [Dobson-Kalish 1988].

The commodity exchange yields are typically anticyclical in the sense that they are generally independent from the economic boom, and – depending on product variety – result lower yield for investors in case of stock exchange booms and higher yield in case of recession [Bodie et al. 2009].

The current examination primarily focuses on the Central Eastern European region, including the Hungarian commodity exchange experiences. It is obvious that the commodity and money markets of the countries typically move together. It has a lot of aspects, out of which the yields and the demand-supply influencing factors should primarily be highlighted. During the recent decade the land ownership and farm structure has changed in the region – it has been considerably diversified in some countries – due to the social-economic transition and lower output could be observed compared to the former yields. [Takacs-György et al. 2008]. The relatively low production use contributed, on the one hand, to the decline of yields and, on the other hand, increased the yield uncertainty [Lencsés, Takacs-György 2008]. The reduction of yield uncertainty can be reached not only by the undifferentiated increase of production inputs, but also by the introduction of precision production applying new technological achievements and meeting the requirements of sustainability [Takács-György, Barkaszi 2006]. It requires, however, some expensive technological improvements which need a production size threshold determined for the implementation

of the technology [Takacs-György 2007] as well as the involvement of external sources which have an impact on farm business risks. [Dodson, Koenig 2003]

The changes of supply and demand, as well as the surplus or shortage of goods on the market have decisive impact on market prices. From this aspect, the production year of 2007 and 2008 brought a new element in the grain prices. The total grain production of the world increased during this period [The state of food and agriculture 2008] but the consumption grew at a more rapid pace which led – in case of maize – to the reduction of reserves and to the rising of prices. Significant factors in the increasing demand were, on the one hand, the growing consumption due to the economic growth of developing countries, and, even to a greater extent, increasing utilisation of renewable energy sources, including the grain-based bio-ethanol production. The worldwide growing bio-ethanol producing capacities have become considerable demand factors, threatening the food supply and fodder needs and contributing to the price rise. [Luchansky, Monks 2009; Rathman et al 2009, Srinivasan 2009]

In summer 2008, however, the experiences of many decades have been questioned by the situation in the grain section of the commodity exchange following the crisis when the American mortgage market collapsed [Piesse, Thirtle 2009]. The volatility of the spot markets increased and the price growth of forward markets was considerably greater than before.

The internal relations of changes have been examined by a lot of authors, who were looking for the connections between the price mechanisms of different commodity markets [Dahl, Iglesias 2009, Hüseinov 2008, Siczek, Hołyst 2009].

The present article focuses on the agricultural products – namely fodder wheat and fodder maize – which are important from the aspect of Central Eastern European commodity exchanges.

Our objective is to analyse the possible relations between the grain prices at the commodity exchanges in 2008 and the movements of exchange rates at the stock exchanges.

Hypothesis: the commodity exchange is more or less independent from stock market processes but the money market crisis of 2008 concerned not only the stock markets but also the prices of commodity exchange goods, especially the grain prices.

Material and methods

The empirical data of the examination: the index of the stock section of Budapest Stock Exchange (BUX), out of the stocks traded in the section the daily closing rate of the largest Hungarian company (MOL – oil industry company) and leading bank (OTP) in the interval from 01.01.2005 to 03.04.2009; the daily average price of fodder maize traded on the forward market of the commodity section in the interval from 01.01.2005 to 03.04.2009 and the daily average price of fodder wheat from 01.01.2006 to 03.04.2009. The price movements at the commodity exchange were analysed in HUF and EUR rates. Until August 2008 the HUF was strong against EUR, then – decisively moving together with PLZ and CZK – has weakened considerably.

We used the so-called Japanese candlestick chart – applied by the technical analysts all over the world – for the analysis of commodity rates (the chart was created by Munehisa Homma rice trader around 1750 and has been used in exchange practice for about 150 years). The candlestick graphically describes the opening and closing prices of the maturity date (body of the candle) and the minimum and maximum prices of the trading time interval (shadows). The colour of the candle body gives information about the trading type: light = increasing rate between open and close within the time interval, dark = decreasing rate between open and close within the time interval. The range limits could be temporarily crossed by the prices during the time interval [Bodie et al. 2009]. The chart is used on the markets with great turnovers (typically stock markets) for describing the daily rate movements. Since, however, the turnover of commodity market goods we examine is relatively small, the number of dealing days for one delivery date was between 1 and 133, the number of deals between 1 and 2165, therefore the movements within the duration of forward deals was described with the candlesticks. The value for comparison is shown by a horizontal bold line on the figure, that is the market average price valid at the maturity of forward deal.

The closeness of fitting (joint moving) of rates was analysed by the Pearson correlation:

$$\rho(X, Y) = \frac{\text{Cov}(X, Y)}{\sigma_x \cdot \sigma_y}$$

where: $r(X,Y)$ = correlation of X and Y rate sequences (index of their joint movement); $Cov(X,Y)$ = covariant of X and Y rate sequences (sum of multiplication products of the date-pairs' deviation from average); s_x and s_y = dispersion of X and Y rate sequences.

Calculation of covariance:

$$Cov(X, Y) = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{X}) \cdot (y_i - \bar{Y})$$

where: n = number of time sequence elements; x_i and y_i = time sequence elements of X and Y rates; \bar{X} and \bar{Y} = time sequence average of X and Y rates.

It is well-known that if the correlation coefficient is +1: the rates of the two examined products move completely together; if it is 0: the rates of the two products are independent from each other; if it is -1: the rates of the two products move totally in the opposite direction.

The intensity and trend of rate movements of forward deals per maturity was examined by the parameter which gives the slope of the linear regression line:

$$b = \frac{Cov(X, Y)}{\sigma_x^2}$$

where: b = the slope of linear regression function; σ_x^2 = time sequence variant of X rate.

The dispersion of forward deals was examined by f-test, the significance of slope per delivery dates was examined by t-test.

Results

During the examined period, the index of the Budapest Stock Exchange (Figure 1) showed an increasing tendency with smaller fluctuations. Then the growth stopped and it lost one-third of its value until September 28, then the decline accelerated during the next three months and lost again one-third of the former top value. During this period, the grain prices rose constantly until May 2007 (following the above mentioned regularities (Figure 2) with low dispersion) and the pace of the growth was below the pace of the growth of stock rates. At that time – due to the rising world market prices and the unfavourable yield forecasts in Hungary – the grain market prices

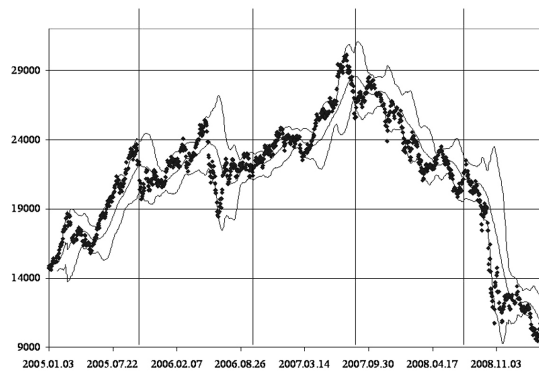


Figure 1. The exchange rate index (BUX) of Budapest Stock Exchange (2005-2009)
Source: own construction.

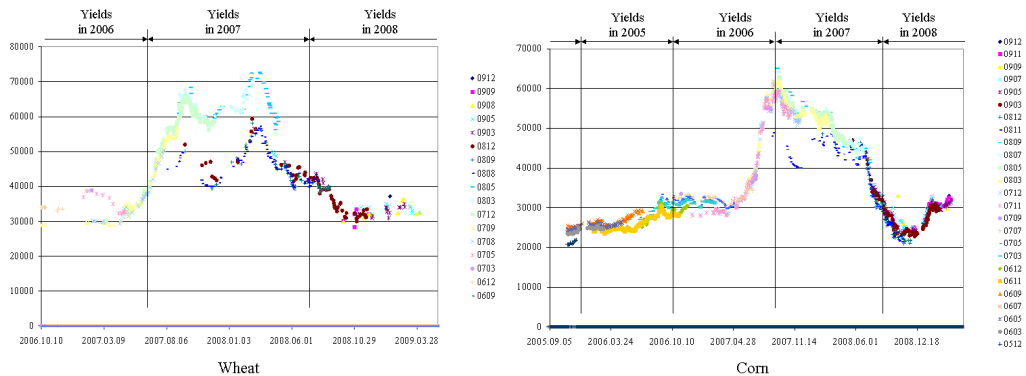


Figure 2. Forward rates of fodder wheat and fodder maize in the Grain Section of Budapest Stock Exchange (2005-2009)
Source: own construction.

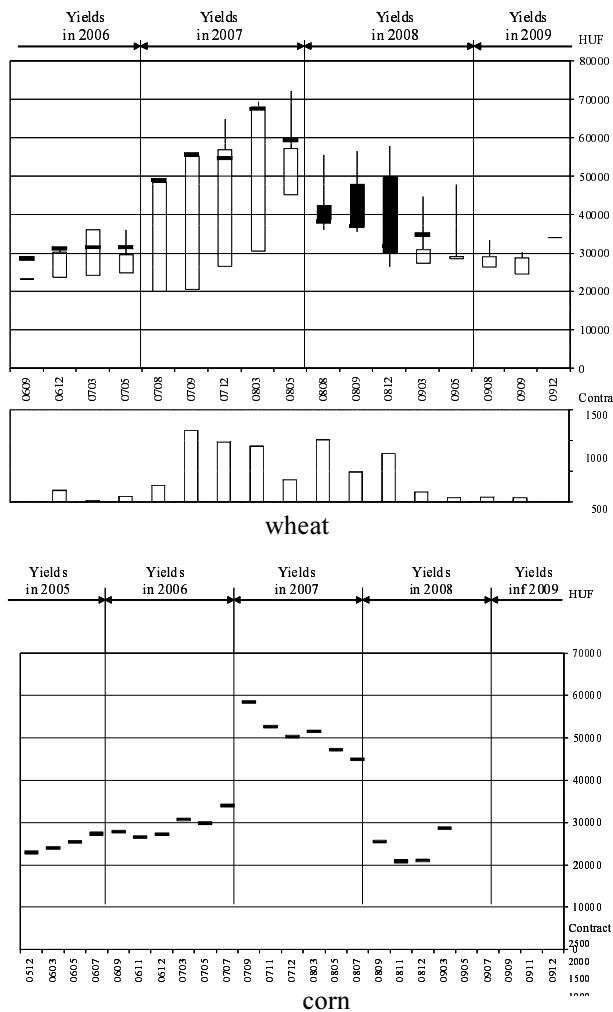


Figure 3. Forward rates of fodder wheat and fodder maize by maturities of deals in the Grain Section of Budapest Stock Exchange (2005-2009)
 Source: own construction.

December of 2008/2009 the movements of commodity exchange and stock market rates showed correlations which were stronger than ever. From January 2009, the prices has broken away from each other and shown only weak, sometimes negative relations. (On the one hand, this indicates the uncertainty of the market, and, on the other hand, the price determining role of the market is weak due to the low number of deals on commodity market – which is again the sign of the uncertainties on the market.)

The intensity of changes and the volatility of the commodity market is indicated by the fact (Table 2) that the typically low slope until the middle of 2007 and the low relative dispersion value increased (rose to 120-140 HUF/t/day) then the movement of rate sequences of forward deals maturing in 2008 has negative slope (in case of some maturities the pace of rate decline was 90-120 HUF/t/day with significant turnover).

Out of the two examined goods on the commodity exchange, the rate fluctuations of fodder maize were more significant which can be explained by the higher degree of demand fluctuations on the product due to the increasing needs of bio-ethanol production.

jumped significantly. The volatility of the rate increased. The Japanese candlesticks describe this on Figure 3. It can also be observed that it was close to or mostly above the spot market price valid at the maturity of forward deals.

In the summer of 2008 the movement turned around. The trades started with high open prices for the different maturities, then the better yield results next year and the expectations of recession launched a phenomenon which could not be seen in the former decade. The commodity exchange and spot market prices slumped, together with the relatively high turnover of the former in case of fodder maize. Upon the maturity of forward deals the spot market prices were regularly below the maturity close prices. As the result of the price slump the prices of the fodder grains fell to the level seen two years before. This phenomenon stopped short late December 2008 and the prices started to move again according to the former experiences from January 2009. With small turnover of fodder wheat deals made for maturity in 2009, the HUF rate is slightly increasing and the EUR rate is sidling. In case of fodder maize, the HUF rate rising is intensive, the EUR rate is more moderate due to the weakening HUF, but it is still increasing.

Examining the joint movement of commodity exchange and stock market it can be stated (Table 1) that in the economic year of 2007/2008 the formerly medium strong relation between commodity exchange rates further weakened, later on until the end of December of 2008/2009 the movements of commodity exchange and stock market rates showed correlations which were stronger than ever.

Table 1. Correlation of fodder wheat and fodder maize rates to the index of Budapest Stock Exchange (BUX) and some of its top stocks (2006-2009)

| 2006.09.01-2007.08.31 | Wheat [HUF] | Wheat [EUR] | Corn [HUF] | Corn [EUR] | BUX | OTP | MOL |
|-----------------------|-------------|-------------|------------|------------|-------|-------|-------|
| Wheat [HUF] | 1.000 | | | | | | |
| Wheat [EUR] | 0.987 | 1.000 | | | | | |
| Corn [HUF] | 0.961 | 0.949 | 1.000 | | | | |
| Corn [EUR] | 0.960 | 0.963 | 0.992 | 1.000 | | | |
| BUX | 0.828 | 0.887 | 0.684 | 0.749 | 1.000 | | |
| OTP | 0.690 | 0.787 | 0.530 | 0.624 | 0.936 | 1.000 | |
| MOL | 0.852 | 0.866 | 0.771 | 0.808 | 0.939 | 0.777 | 1.000 |
| 2007.09.01-2008.08.31 | Wheat [HUF] | Wheat [EUR] | Corn [HUF] | Corn [EUR] | BUX | OTP | MOL |
| Wheat [HUF] | 1.000 | | | | | | |
| Wheat [EUR] | 0.985 | 1.000 | | | | | |
| Corn [HUF] | 0.786 | 0.744 | 1.000 | | | | |
| Corn [EUR] | 0.739 | 0.718 | 0.985 | 1.000 | | | |
| BUX | 0.521 | 0.522 | 0.780 | 0.798 | .000 | | |
| OTP | 0.480 | 0.490 | 0.673 | 0.700 | 0.971 | 1.000 | |
| MOL | 0.501 | 0.490 | 0.836 | 0.851 | 0.931 | 0.838 | 1.000 |
| 2008.09.01-2009.04.03 | Wheat [HUF] | Wheat [EUR] | Corn [HUF] | Corn [EUR] | BUX | OTP | MOL |
| Wheat [HUF] | 1.000 | | | | | | |
| Wheat [EUR] | 0.840 | 1.000 | | | | | |
| Corn [HUF] | 0.786 | 0.744 | 1.000 | | | | |
| Corn [EUR] | 0.739 | 0.718 | 0.789 | 1.000 | | | |
| BUX | 0.541 | 0.883 | 0.203 | 0.731 | 1.000 | | |
| OTP | 0.509 | 0.868 | 0.183 | 0.726 | 0.992 | 1.000 | |
| MOL | 0.548 | 0.874 | 0.163 | 0.696 | 0.988 | 0.978 | 1.000 |
| 2008.09.01-2008.12.31 | Wheat [HUF] | Wheat [EUR] | Corn [HUF] | Corn [EUR] | BUX | OTP | MOL |
| Wheat [HUF] | 1.000 | | | | | | |
| Wheat [EUR] | 0.982 | 1.000 | | | | | |
| Corn [HUF] | 0.843 | 0.874 | 1.000 | | | | |
| Corn [EUR] | 0.812 | 0.936 | 0.965 | 1.000 | | | |
| BUX | 0.804 | 0.893 | 0.747 | 0.881 | 1.000 | | |
| OTP | 0.780 | 0.875 | 0.761 | 0.894 | 0.991 | 1.000 | |
| MOL | 0.825 | 0.903 | 0.727 | 0.860 | 0.987 | 0.973 | 1.000 |
| 2009.01.01-2009.04.03 | Wheat [HUF] | Wheat [EUR] | Corn [HUF] | Corn [EUR] | BUX | OTP | MOL |
| Wheat [HUF] | 1.000 | | | | | | |
| Wheat [EUR] | 0.917 | 1.000 | | | | | |
| Corn [HUF] | 0.078 | -0.189 | 1.000 | | | | |
| Corn [EUR] | 0.240 | 0.085 | 0.804 | 1.000 | | | |
| BUX | 0.140 | 0.451 | -0.597 | -0.135 | 1.000 | | |
| OTP | 0.087 | 0.407 | -0.635 | -0.168 | 0.973 | 1.000 | |
| MOL | -0.319 | -0.143 | -0.341 | -0.064 | 0.677 | 0.632 | 1.000 |

Source: own calculation.

Table 2 The rates of fodder wheat and fodder corn in Budapest Stock Exchange and the trend of movements (2006-2009)

| Wheat | | | | | | | | | | Maize | | | | | | | | | |
|--|------------------------------|-------------------|----------------------|---------------------------------|---|---------|-----------------|-----------------------|------------|--|-------------------|----------------------|---------------------------------|--------------------|---|-----------------|-----------------------|--|--|
| Trend of futures prices depend on time | | | | | Regression analysis of futures prices depend on BUX | | | | | Trend of futures prices depend on time | | | | | Regression analysis of futures prices depend on BUX | | | | |
| Term-inate | Number of trading days [pcs] | Quantity [1000 t] | Means of price [HUF] | Relative standard deviation [%] | Slope [HUF/ t/day] | r value | F-signi-ficance | p-value of X variable | Termi-nate | Number of trading days [pcs] | Quantity [1000 t] | Means of price [HUF] | Relative standard deviation [%] | Slope [HUF/ t/day] | r value | F-signi-ficance | p-value of X variable | | |
| Futures contracts terminated in 2009 | | | | | | | | | | | | | | | | | | | |
| 0912 | 1 | 0.1 | 37200 | 0.00 | 0.0 | .. | .. | .. | 0912 | 5 | 2.1 | 31040 | 4.05 | 38.8 | 0.872 | 0.054 | 0.054 | | |
| 0909 | 6 | 6.5 | 31330 | 5.35 | 36.4 | 0.305 | 0.556 | 0.556 | 0911 | 18 | 16.1 | 29939 | 8.67 | 57.5 | 0.630 | 0.007 | 0.007 | | |
| 0908 | 12 | 7.5 | 32514 | 5.53 | 19.5 | 0.633 | 0.036 | 0.036 | 0909 | 5 | 12.7 | 28600 | 8.95 | -7.8 | 0.166 | 0.790 | 0.790 | | |
| 0905 | 15 | 6.0 | 36749 | 17.15 | -49.5 | 0.964 | 0.000 | 0.000 | 0907 | 26 | 35.9 | 28078 | 8.79 | 32.2 | 0.236 | 0.256 | 0.256 | | |
| 0903 | 19 | 15.8 | 35673 | 13.67 | -49.5 | 0.919 | 0.000 | 0.000 | 0905 | 66 | 57.7 | 29361 | 10.84 | -8.6 | 0.453 | 0.000 | 0.000 | | |
| | | | | | | | | | 0903 | 103 | 142.6 | 28629 | 16.71 | -33.1 | 0.593 | 0.000 | 0.000 | | |
| Futures contracts terminated in 2008 | | | | | | | | | | | | | | | | | | | |
| 0812 | 72 | 78.3 | 39526 | 17.38 | -50.9 | 0.798 | 0.000 | 0.000 | 0812 | 72 | 119.6 | 29052 | 23.65 | -123.1 | 0.717 | 0.000 | 0.000 | | |
| 0809 | 62 | 49.0 | 43888 | 11.85 | -35.4 | 0.409 | 0.001 | 0.001 | 0811 | 133 | 216.5 | 36704 | 23.32 | -61.9 | 0.720 | 0.000 | 0.000 | | |
| 0808 | 116 | 100.8 | 46099 | 11.24 | -5.9 | 0.167 | 0.074 | 0.074 | 0809 | 34 | 33.8 | 45264 | 19.35 | -87.3 | 0.818 | 0.000 | 0.000 | | |
| 0805 | 52 | 36.1 | 63300 | 8.08 | 22.8 | 0.414 | 0.002 | 0.002 | 0807 | 72 | 85.4 | 48756 | 9.10 | -66.1 | 0.752 | 0.000 | 0.000 | | |
| 0803 | 71 | 90.8 | 62519 | 7.71 | 29.5 | 0.113 | 0.347 | 0.347 | 0805 | 87 | 80.7 | 52125 | 8.49 | -24.3 | 0.594 | 0.000 | 0.000 | | |
| | | | | | | | | | 0803 | 123 | 131.3 | 52480 | 13.48 | 32.0 | 0.104 | 0.253 | 0.253 | | |
| Futures contracts terminated in 2007 | | | | | | | | | | | | | | | | | | | |
| 0712 | 80 | 97.7 | 56519 | 13.64 | 125.4 | 0.021 | 0.851 | 0.851 | 0712 | 120 | 180.0 | 47352 | 23.19 | 120.6 | 0.384 | 0.000 | 0.000 | | |
| 0709 | 79 | 115.8 | 40861 | 23.44 | 106.3 | 0.734 | 0.000 | 0.000 | 0711 | 122 | 177.1 | 42615 | 27.46 | 140.5 | 0.560 | 0.000 | 0.000 | | |
| 0708 | 46 | 26.3 | 36307 | 18.49 | 94.7 | 0.914 | 0.000 | 0.000 | 0709 | 6 | 1.4 | 42483 | 20.92 | 56.7 | 0.092 | 0.863 | 0.863 | | |
| 0705 | 21 | 9.0 | 34927 | 7.51 | 1.7 | 0.191 | 0.406 | 0.406 | 0707 | 54 | 67.1 | 32417 | 3.38 | 0.9 | 0.364 | 0.007 | 0.007 | | |
| 0703 | 4 | 2.2 | 31025 | 14.72 | 58.4 | 0.910 | 0.090 | 0.090 | 0705 | 92 | 171.5 | 31622 | 2.98 | -5.2 | 0.191 | 0.069 | 0.069 | | |
| | | | | | | | | | 0703 | 95 | 209.7 | 31037 | 2.82 | 6.6 | 0.550 | 0.000 | 0.000 | | |
| Futures contracts terminated in 2006 | | | | | | | | | | | | | | | | | | | |
| 0612 | 21 | 18.5 | 31932 | 8.89 | 70.5 | 0.441 | 0.046 | 0.046 | 0612 | 92 | 103.0 | 27433 | 8.06 | 25.8 | 0.071 | 0.500 | 0.500 | | |
| 0609 | 1 | 0.1 | 27000 | 0.00 | 0.0 | .. | .. | .. | 0611 | 106 | 122.5 | 26371 | 6.83 | 17.9 | 0.026 | 0.788 | 0.788 | | |
| | | | | | | | | | 0609 | 13 | 3.4 | 27201 | 3.60 | 15.6 | 0.481 | 0.096 | 0.096 | | |
| | | | | | | | | | 0607 | 48 | 20.2 | 26792 | 5.11 | 15.4 | 0.337 | 0.019 | 0.019 | | |
| | | | | | | | | | 0605 | 66 | 44.7 | 25311 | 2.50 | 8.4 | 0.723 | 0.000 | 0.000 | | |
| | | | | | | | | | 0603 | 47 | 55.4 | 24549 | 2.58 | 13.6 | 0.601 | 0.000 | 0.000 | | |

Remarks: If F-significance is higher than 0.05 the futures commodity prices are independent from BUX.
Source: own calculation.

Conclusions

The examinations proved that the trade of fodder maize and fodder wheat in Hungary – which are the most significant ones among the products traded on the commodity exchange – could not remain independent from the almost panicky stock market rate declines. Furthermore, the fodder prices, which ran away in the previous year, have not simply gone back to normal knowing the yield results, but the commodity exchange prices and stock market rates moved closely together for six months. The price movements of grain section of the exchange could break away from the price movements of the stock section only early 2009, thus the Out hypothesis has been proved. The break in the process, however, indicates that the endogenous regularities of the commodity market can prevail again after the stress impacts on the market and the price forming, price influencing mechanisms of natural (commodity) market can become stronger again.

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Streszczenie

W artykule podjęto próbę analizy wpływu globalnego kryzysu finansowego na notowania podstawowych produktów rolnych na Budapesztańskiej Giełdzie. Przy wykorzystaniu narzędzi analizy technicznej i metod statystycznych zbadano dla jakich grup produktów ceny wzrosły, a dla jakich zmalały.

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