INVESTORS' MOTIVES AND PRICE TRENDS IN INTERNATIONAL MARKETS AND IN THE GRAIN SECTION OF THE BUDAPEST STOCK EXCHANGE[1]

BEFEKTETŐI MOTIVÁCIÓK ÉS ÁRTRENDEK A NEMZETKÖZI PIACOKON ÉS A BUDAPESTI ÉRTÉKTŐZSDE GABONASZEKCIÓJÁBAN

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ABSTRACT

The operation of futures exchanges and the trading on the floor is hard to be interpreted without knowing the actors' main motivations. For the solution of this problem a lot of information is provided by theories aimed at revealing the motives of hedge deals having gained acknowledgment in the international special literature, whose short introduction in this paper is followed by the setting up of our hypothesis based on some previous Hungarian empirical research results.

According to our presumption the liquidity deficiency and the adaptive expectations of exchange market actors has a great impact on the operation of the Hungarian grain futures market. As a consequence, information affects the grain futures trade in a cumulative way in Hungary, therefore the efficient market hypothesis does not hold in the case of these markets.

In our research we analysed the time series of the closing prices of the fodder wheat and fodder maize futures trade in years between 2001 and 2006, relying on the methods of preceding research published by the co-authors Lakner and Vizvári in 2003 examining the time series of the same produces between 1991 and 2000, with the help of linear and non-linear extrapolation.

The effectiveness of the linear extrapolation has confirmed the presumption that the futures trade can be unambiguously characterised with the adaptive expectations of market participants. The actors bide their time, validate their information in a cumulative manner by the opening and closing of their market positions alike.

Keywords: futures commodity exchanges, efficient market hypothesis, random walk, linear and nonlinear processes

[1]The grain trade belonged to the Budapest Commodity Exchange until the unification of the two markets in 2005.

INTRODUCTION

As the third millennium was setting in, the world economy was becoming the stage of considerable changes. The unifying economic regulations are also the results of that world economic process in which the greater part of the economic output comes into existence through the nets of transnational and multinational companies. In the financing of their resources capital and commodity markets are taking up an increasingly important role. In the United States, Europe and in the developed countries of the Asian area traditional bank credits are being replaced by direct capital financing.

While capital markets are coming to prominence, modern commodity markets are also gaining ground among investment options due to their world market price sensitivity, and futures trading possibilities offering price insurance opportunities provided by hedge deals.

In Hungary and in the Central and Eastern European Countries capital and commodity markets were reopened somewhat before or after transition. Though the international attendance in Central-European exchanges is not considerable, their turnover and capitalisation is not even comparable to those of developed markets, through the visualisation of world economic processes their economic significance has become determinative.

Our main motivation throughout this research on these capital and commodity markets was to discover some characteristics, which are rarely in focus of attention. In this paper we publish the results of the analysis of agricultural goods traded in the Hungarian commodity exchange.

The appearance of international scientific books, discussions and journal articles studying the operation and economic role of commodity futures markets have accumulated a lot of knowledge , however, the Hungarian special literature does not – perhaps due to the lack of interest – look back to a significant past. In Hungary, not like in developed countries, investors seem to have less interest in placing their savings in this manner and trading in the exchange markets is girdled with some kind of mystery. Their operation – if possible - seems to be even more thorough and inscrutable for the uninitiated eyes of a layman.

Some theories on hedging in commodity futures markets

Investors' claim for determining the direction of price movements emerged simultaneously with the forming of new exchange markets. Price guarantee and a possible increase in the available profit are not indifferent aspects for any investor.

In the course of time theories, naturally, have become more and more compound and exact, and the extension of the market is being followed by the proportionate increase of resources used for analysis. The various pricing theories and empirical research efforts are aimed at explaining or describing the commodity and stock exchange processes.

Though analysis plays an important part also in this field of life, it is important to note that trading in the exchange markets and the processes taking place there are often not to be interpreted scientifically, and sometimes the hectic movement of prices is lacking any rationality.

Despite the above mentioned, the work of analysers can be still regarded useful, as in the case of stable, developing markets price movements can be well estimated with the help of different theoretical approaches. Data explorers do not have to cope with serious difficulties either, as exchanges serve a great bunch of data for an economist wishing to search and analyse the behaviour of market actors thanks to the great number and continuity of transactions as well as the public listing of prices.

The view of economists examining commodity markets differs in the question of the utility of commodity futures market products by large. The difference in opinion creates a major clash of conflicting ideas in the ajudication of the motives of market actors and the behaviour of speculators. In the last six decades having passed since the initial research efforts some theories - summarised below on the basis of the study by Pennings and Leuthold [27] - have become well-known among experts.

The followers of the theory of price of storage by Working [37] came to the conclusion that the difference between the present and the expected future grain prices does not usually equal the costs of renting storage space, the depreciation of grain, the foregone opportunity of investment, and insurance etc. because costs usually exceed the seasonal price increases due to other benefits to grain storage such as long-distance trade gains and newly-developed financial instruments [Poynder [28]]. Working disagreed with the views of Keynes on backwardation (or negative carry), which argued that short hedgers (farmers) drive down futures prices because of their demand for price insurance. He emphasised that the relationship between the prices quoted for different delivery terms should be in focus of attention not the overall price level. Working's contribution to futures price theories anticipated the efficient market hypothesis and established an early theory of market maker behaviour.

The efficient market hypothesis is an important pillar of the portfolio theory and finance. A great number of empirical research supported the theory, without an entire enumeration, we can mention the names of Working [36],

Granger and Morgenstern [12], Samuelson [30] and Fama [8]. In this interpretation a market can be regarded as efficient if share prices always immediately incorporate and reflect all relevant information

According to the hypothesis, in efficient markets – and it can be interpreted for both capital and goods markets – the actual price of a product (stock, commodity, derivative) is a good estimate of its intrinsic value and the next period expected value of the same product equals its actual price with the given information set available.

The market can be described with efficient information flow, rational expectations, minimal transaction costs, continuous trading, scattered market and that investors expect higher yields for higher risk. If the equilibrium capsizes as a consequence of any event, the activity of arbitrageurs will restore it immediately. The change of the futures prices is erratic, past price movements can not predict future price movements, and price movements will not follow any patterns or trends in time and therefore can be modelled as "random walk". The degree of the efficiency - according to the classification of Fama [9] - of the market is determined by the degree of the exploitation of the available (past and current) information.

In the history of theories of finance the Efficient Market Hypothesis (EMH) became a milestone in the 70's and grounded for the establishment of the Capital Asset Pricing Model (CAPM)

The fundamentals of the price insurance theory of hedging were established by Keynes [18], Kaldor [16] and Blau [5] who discussed hedging in terms of risk avoidance and insurance. According to the hypothesis the loss of the hedger on the completed hedge transaction is realised as insurance premium by the risk-assuming speculator. This theory lays down the principles of hedging indeed.

Working [38] who elaborated the earnings returns theory of hedging questioned the existence of the risk premium and regarded the hedge deals primarily as a source of profit-making provided by the anticipated relative change in the price conditions of the futures and the physical markets (the basis). He regarded hedge deals primarily as an arbitrage opportunity. Later he reappraised his approach and found that the reason for hedgers to pay to speculators appears is that they are interested in reducing the interval in which their inventories are left uncovered, exposed to the risk of price change.

The portfolio theory of hedging is based on the risk-avoiding character of market actors. Its theorists Johnson [14] and Stein [31] built upon their explanation of futures market activity on the portfolio theory of Markowitz [24] which says that market actors make up their portfolios on the basis of yields weighed with risks. In this view a hedger is maximising its utility by creating a portfolio of cash and futures. Williams' [35] criticism against this approached pointed out that that the important risks (availability of commodities) are hard to diversify.

The essence of the liquidity theory established by Telser [33] is that organised futures commodity markets are superior to forward markets as they provide guarantee for alien market actors through their written rules, standadisation and institutions. The concentrated market ensures the necessary liquidity and promotes trade through eliminating counter-party risk.

In the loan markets theory of hedging Williams [35] based his statesments on the theory of storage. A functioning loan market (indeed the futures market) for commodities improves the allocation of reserves over time, as the market directs stocks to those firms whose need for them is most immediate and creates demand for those holding them.

In his opinion hedgers are not motivated by price changes but hold inventories to reduce the costs and the inflexibility of production, transportation and processing.

The theory of contract relationships of hedge deals elaborated by Pennings and Leuthold [27] does not suggest an optimal hedging strategy. According to the theory futures contracts promote the formation of contractual relations between market actors through the simplification of making contracts and strengthening of long-run relationships and thus reliability.

From a theoretical point of view some doubtful questions are to be mentioned here. An interesting contribution to the theory of future contracts was made by Roll [29] examining the relationship of the exchange price of weather and orange juice. Though on the one hand he found a significant relationship between cold days and the inaccuracies of weather forecast and the price of the chilled orange juice but he could not statistically confirm that the rainfall forecast would play any role in the change of the price. Thus the exchange price is not in close relationship with the price that can theoretically be calculated on the basis of stable market circumstances and the rainfall as main factor influencing it. We can phrase it in a different way: the price of the orange juice futures contracts have got nothing to do with the fundamental value formed by the demand and supply of the goods market.

Though the various approaches provide a profound examination of a certain field of the problem, during the practical application the representatives of the profession could not find a common ground about a comprehensive, generally applicable theory for the appropriate modelling of the behaviour of markets.

Further on, during the introduction of quantitative

analyses we will see that it is not accidental that we run up against difficulties by setting up the right theoretical model. The behaviour of markets is influenced by numerous factors which are not independent from each other and market actors do not behave in a rational way. Despite the obvious difficulties scientific researchers and analysing experts of the field are being spurred to elaborate new theories by the professional curiosity and the never ceasing demand of market actors.

To our mind, it can be stated – as it will be underpinned by the research results introduced further on - that markets (be capital, commodity or futures commodity markets) behave in a rather distinctive manner, economic factors continuously affect market processes, and the motives of the actors is variable. A commonly applicable, uniform, comprehensive theory can not be adopted for describing the behaviour of markets. The Hungarian special literature is scarce comparing to the international not only in relation to theoretical approaches but also to empirical investigations. The number of research activities aimed at examining the futures trade is fairly low. Despite this in the national professional – first of all in the scientific – literature we can come across some respectable work. The empirical research results to be introduced below can raise our attention before all because they reveal the distinctive characteristics of the national futures trade comparing to that taking place in the international markets. After a survey of different processes it is recommendable to examine the price movements with the help of a model best decribing the market.

The empirical investigation of efficient markets and the chaos theory

As for a long time classical linear methodologies failed to solve the problem of prediciting market processes, a series of studies were devoted to confirm the randomness of markets. As Fama's [9] survey also pointed out, the vast majority of studies aimed at studying the efficiency of stock market price formation were unable to reject the "efficient markets" hypothesis for common stocks. Though Leroy [21] and Lucas [23] have proved that rational expectations equilibrium prices need not even form a martingale sequence, of which the random walk is a particular case, efficient market approaches are broadly categorized as the "random walk" theory of stock prices.[2]

Some studies in the 80's - eg. Keim and Stainbaugh [17] and Fama and French [10] - however, found that there are some well-predictable elements of stock market prices and holding-period returns. Moreover, Andrew W. Lo and A. Craig MacKinlay [22] tested the random walk hypothesis for weekly stock market returns for the sample period 1962-1985 for a variety of aggregate returns indexes and size-sorted portfolios from the NYSE-AMEX and rejected random walk for most of the time series under examination by using a simple volatility-based specification test. They also concluded that the results were not a consequence of infrequent trading.

As in latest literature most of the authors have not not rejected the predictability of some market trends and considering the complexity of markets, nonlinearity seems to bear better results with respect to random walk hypothesis, thus nonlinear models have become the most wide-spread for describing market processes. In such cases during the examination of the impact of expectations on prices long-run adaptation processes are also taken into consideration. The choice between nonlinear approaches is by far not that easy and the capability of different approaches to achieve good results is influenced by the degree of chaotic dynamics characterizing the market.[3]

Among others William A. Barnett and Apostolos Sarlatis [4] surveyed some outstanding work aimed at analysing the efficient market hypothesis with chaos theoretical tools. They use the study of Campbell, Lo, and MacKinlay [6] as a starting point establishing two important findings: (1) some predictability of financial asset returns does not necessary leads us to the to an „outright rejection" of the efficient market hypothesis, (2) some factors of the security markets are by their nature nonlinear (investors' attitude towards risk and expected return, market interactions, the dynamics of economy-wide fluctuations etc.) which makes it reasonable to analyse nonlinear or chaotic processes. The authors' summary on the main

[2] Namely the martingale difference requires only independence of the conditional expectation of price changes from the available information, whereas the (more restrictive) random walk model requires this and also independence involving the higher conditional moments (i.e., variance, skewness, and kurtosis) of the probability distribution of price changes.

A random walk, sometimes called a "drunkard's walk," is a formalization in mathematics, computer science, and physics of the intuitive idea of taking successive steps, each in a random direction. For example, the path traced by a molecule as it travels in a liquid or a gas is a random walk.

A one-dimensional random walk can also be looked at as a Markov chain whose state space is given by the integers i= 0, ±1, ±2…, for some number 0<p<1, Pi,i+1=p=1-Pi,i-1. We can call it a random walk because we may think of it as being a model for an individual walking on a straight line who at each point of time either takes one step to the right with probability p or one step to the left with probability 1 − p. A random walk is a simple stochastic process. Source: Wikipedia

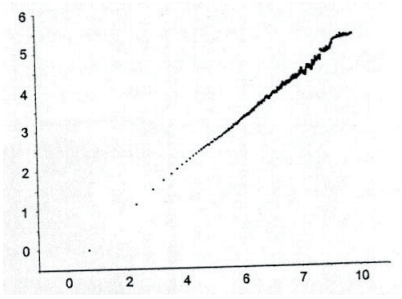
[3] "…chaos is a nonlinear deterministic process that looks random because it is the result of an irregular oscillatory process influenced by an initial condition and characterized by an irregular periodicity." Source: :Mattarocci (2006) p.30

results of the literature testing linear and non-linear processes reveals that there is clear evidence of nonlinear dependence and some signs of chaos in financial data[4] They also called the attention to the controversies of various tests and mathematical approaches which are not able to distinguish between chaotic external shock or the chaotic structure of the economy as well.[5] Gianluca Mattarocci [25] analysed the relationship between the main characteristics of stock markets and the degree of chaotic dynamics over the most representative market indexes of various countries, with a total of fifty indexes. He based his research on the chaos theory assuming that the returns dynamics are not normally distributed and referred to the Fractal Market Hypothesis[6] which states that the returns dynamics are, moreover, not independent of the investors' attitudes and represent the result of the interaction of traders who, frequently, adopt different investment styles, therefore linear models are not adequate methods for describing these markets. The author used the R/S analysis (see later) to check the role of past dynamics and came to interesting conclusions: (1) "with reference to each time period being considered, it may be ascertained that a higher (lower) level of transactions implies a lower (higher) capability of the linear model to explain the market dynamics", (2) liquidity influences the deviation from linearity, the degree of chaos, and the periodicity, (3) the markets being considered seem to point to the presence of chaotic dynamics, processes different from random walk.

Depending how the given exchange can be featured with the efficient market theory, a different mathematical-statistical approach is to be applied. We can well presume that the most frequented exchanges of the world approximately meet the main postulates of the above theory.

Since the mid 80's, as we could see above, a lot of criticism and empirical disproof was raised against the main presumprions of the Efficient Market hypothesis, which became general and almost fashionable among international mainstream financial researchers in the 90's. It was partly confirmed that capital markets do not always meet the criteria of information efficiency.

The unfolding of one of the new approaches, the behavioural finance can be attached to the article of De Bondt–Thaler [7] which was preceded by the so-called Kahneman–Tversky [15] prospect theory. The article focused on the subject of risk in individual decision preferences. The basis of the prospect theory is a value function which examines the motive in the individual's relation towards profit that one unit loss can only be compensated by more than one unit of loss. According to some survey (as cited in Barberis–Huang–Santos [3]) one



Closing prices	Logarithmic yields	
	$n_l = \log \frac{P_t}{P_{t-l}}$	
	H	R^2
1999.01.02-1994.02.02	0,540	0,975
1994.02.02-1995.12.29	0,504	0,992
1995.12.29-1997.08.06	0,515	0,998
1997.08.06-2000.05.18	0,604	0,998

Figure 1 The R/S analysis of the daily closing price of the Dow Jones-index (Source: Fokasz N. [11])

[4] Among others reserach of Scheinkman and LeBaron (1989) on weekly returns of US security prices or of Serletis and Gogas (1997) on East European black market exchange rates pointed at chaotic elements in financial series.

[5] For example the estimates of the fractal dimension, the correlation integral, and Lyapunov exponents of a dynamcial system.

[6] Fractal Market Hypothesis was proposed by Peters (1994) following Mandelbrot's discovery of fractals in the financial markets. The hypothesis (FMH) basically says that the market is stable when investors appearing in the market make deals for a large number of investment horizons, and information is valued according to the investment horizon of the investor. As the different investment horizons attach different value to information, the diffusion of information will also be uneven. At any one time, prices, different form the efficient market hypothesis, may not reflect all available information, but only the information relevant to that investment horizon (or time frame). As the information horizon becomes the same for all investors, the market turns to be unstable losing its fractal structure.

In mathematics a number that quantitatively describes how an object fills its space is a fractal. Fractals are rough and often discontinuous, and so have fractional, or fractal dimensions. The fractal dimension represents the number of basis elements (fractals) necessary to define an object. Source: The Fractal Market Hypothesis. http://financial-dictionary.thefreedictionary.com

In finance, the fractal dimension shows the elements necessary for describing the market, of the higher the complexity of the time series being analysed, the higher the estimated fractal dimension. Source: Mattarocci (2006)

unit of loss can be compensated by 2,25 unit of gain.

Barberis–Huang–Santos [3] also used the prospect theory for the formation of an equilibrium pricing model (BHS model). According to the housemoney effect the investors' decisions are largely influenced by the volume of their earlier profit and loss, as a consequence of earlier gain the risk acceptance of the economic actor increases whereas earlier losses decrease this willingness

Barber–Odean [2] called the attention to another phenomenon. Trading through the internet becomes simple and the illusion of control decreases parallelly. As an effect of this investors who are biased against their own knowledge feel that they can manage their portfolio themselves

We disregard the comprehensive introduction of the behavioural finance but it is important to keep track of new tenets appearing in the international literature which though do not claim that Fama's theses are basically wrong but may give interesting contributions to supplement those.

SOME HUNGARIAN RESEARCH RESULTS

Random walk

While focusing on international stock indexes Fokasz Nikosz [11] carried out an examination apprehending the development of exchange prices as a random walk process. In his under cited study he determined the value of the Hurst-exponent with R/S analysis.[7] His research is especially interesting for us as, apart from the analysis of numerous global exchanges of the world, it comprised the examination of the price trends of the Budapest Stock Exchange as well.

As we have dicussed the hypothesis of the efficient market in the previous chapter we can easily realize that it entails the desirability of all public information assimilating in the effective price of the given moment. As a consequence prices change only if new information comes in. Today's news holds very important information from the point of view of the market, whereas the news of yesterday is not significant any more. An important characteristics of financial markets therefore is that the yields of today are independent from those of yesterday. From the point of view of investors it means that the participants of the financial market do not react summing previous changes but immediately and proportianelly to the incoming information. „All variants of market theory presume that if information has once become generally known then the past does not influence the current market activity. Not a single but a possible consequence of the assumption of independence is that yields follow a random walk course." (Fokasz N. [11])

In his research Fokasz Nikosz came to the results listed below:

- He received values ranging from 0,52 to 0,58 of the Hurst-exponent in the markets under examination with slight individual deviations.
- During his examination the daily prices of the Dow Jones proved to be following random walk with good approximation.
- Similar results well approximating random walk arose in several big exchanges of the world, as well as in the case of significant indices: as that of the Hong Kong stock exchange, the Dax, the Nikkei, the Nasdaq and the S&P.

„We can assert in this moment that in the examined cases our results definitely do not confute but rather confirm the hypothesis of the efficient market." (Fokasz N. [11])

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[7] Harold Edwin Hurst (1880-1978) was a British hydrologist. Hurst's (1951) study on measuring the long-term storage capacity of reservoirs documented the presence of long-range dependence in hydrology. Much of Hurst's research was motivated by his empirical observations of the Nile. Source:Wikipedia

The Hurst exponent invented by him is defined as: H:=log(R/S)/log(T)

where T is the duration of the sample of data, and R/S the corresponding value of rescaled range. Where $R_T = \max_{1\le t\le T} X(t,T) - \min_{1\le t\le T} X(t,T)$, $(X(t,T) = \sum_{u=1}^{T}\{\xi_u - \overline{\xi}_T\})$ and S stands for the standard deviation. In this way Hurst generalized an equation valid for the Brownian motion in order to include a broader class of time series. In fact, Einstein studied the properties of the Brownian motion and found that the distance R covered by a particle undergoing random collisions is directly proportional to the square-root of time T:

$R=k*T^{0.5}$

where k is a constant which depends on the time-series. The generalization proposed by Hurst was: $R/S=k*T^H$, where where H is the Hurst exponent.

If H=0.5, the behaviour of the time-series is similar to a random walk;
if H<0.5, the time-series covers less "distance" than a random walk (i.e., if the time-series increases, it is more probable that then it will decrease, and vice-versa);

if H>0.5, the time-series covers more "distance" than a random walk (if the time-series increases, it is more probable that it will continue to increase). Source: P. Vanouplines (1995): Rescaled range analysis and the fractal dimension of π

The author unravels the following results well distinguishable from the earlier ones - during the examination of the price fluctuations - in the Budapest Stock Exchange stemming from the low liquidity and capitalisation of the Hungarian stock market at a world-wide scale:

- In the period between the 2nd January 1991 and 18th May 2000 under examination the behaviour of the index of the Budapest Stock Exchange, the BUX showed a more trend keeping character unlike the leading exchanges of the world.

In the case of daily closing prices as a result of the R/S analysis for a number of 2350 observations under a linear correlation coefficient R=0,987 a H=0,7 Hurst-exponent value was computable.

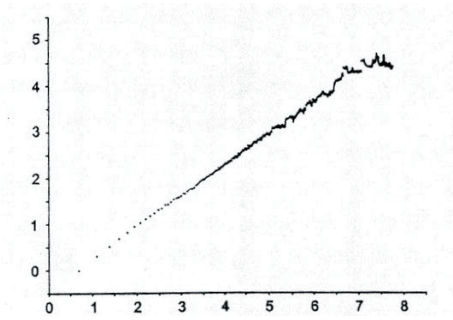


Figure 2 The R/S analysis of the closing prices of the BUX index (Source: Fokasz N. [11])

We can name the time series observable in the Budapest Stock Exchange (BSE) as a process following Brownian motion after Benoit Mandelbrot.[8] The diagrams of these refer to the trend-keeping character of casual processes even visually, they are smoother than the diagrams of the Brownian motion and are the smoother the greater the value of the Hurst-exponent.

Through the evaluation of the results the author found that the reaction in the BSE is not immediate. The investors take their time and neglect the incoming news as long as there is not a clear trend standing out. The investors of the Budapest Stock Exchange thus – differently from the behaviour of international investors – treat new information in a cumulative manner. „The result of other controlling calculations has shown that the BUX-index does not behave as random walk but bears a strongly trend keeping character." (Fokasz N. [11])

In 2007 we analysed [34] the BUX index futures and fodder wheat and maize futures price movements with the help of R/S analysis for the time period 2000-2007 and established similar statements as these markets do not appear to be described by random walk.

Nonlinear processes

In the case of nonlinear processes different from random walk the chaos theory is often the basis for investigation as – for instance - the price of individual financial products can be influenced by other variables than market factors, therefore we can not presume that price movements of this kind meet the prerequisites of the efficient markets.

Among others Muraközi [26] dealt with the applicability of chaotic models. During his analysis he came to the conclusion that models of this kind duly point out the significance of market expectations in economics.

The price of financial products (such as stock, bond, currency etc.) analysed by the author usually shows a trend, the trend is more or less stable, and slightly depends on accidental effects.

His statements can be summarized as follows:

- You can deduce the direction of price changes from previous prices to present prices,
- There are such past events, which have not been or have been imperfectly processed by the market.

„A reason for applying chaos theoretical models is – among others – that these assume non-linear processes whereas in traditional financial models the noise settles on linear trends. It is not likely that anything would ensure the linearity of financial processes, what is more, it would contradict to our intuitions relating to the mazy system." … „In sum, we can see that chaotic models can better describe the dynamics of financial product prices from many aspects than those assuming random walk." (Muraközi B. [26])

The empirical approximation of the price changes of the Hungarian commodity exchange

The examination of price trends of the commodity exchange following the path of some previous research was conducted by the co-authors Lakner-Vizvári in 2003 [20]. In the judgement of the authors the Budapest Commodity Exchange can be best described with a short history, a high rate of the Hungarian inflation, and the

[8] " Brownian motion (named in honor of the botanist Robert Brown) is either the random movement of particles suspended in a fluid or the mathematical model used to describe such random movements, often called a Wiener process. The mathematical model of Brownian motion has several real-world applications. An often quoted example is stock market fluctuations. Another example is the evolution of physical characteristics in the fossil record."Source: Wikipedia

In Physics the Brownian motion is an example for procedures producing 2-dimension fractals. Particles suspended in a fluid follow such a "random walk", where both the direction and the distance are stochastic variables of smooth distribution. If a particle intends to get from a definite point of the plane to another, then its path will surely fill the whole plane before it achieves its destination. Source: KFKI

vigorous cyclical fluctuations appearing in product prices.

In their research they gave a comprehensive analysis of the price movements of maize and fodder wheat futures prices using the closing prices of the Budapest Commodity Exchange between 1991 and 2000. They wished to introduce the inner laws of the Budapest Commodity Exchange through their analytical work.

Their examination covered the application of two models:

(1) The first model approximates the anticipatory prices with the help of linear extrapolative estimation [1] presuming the applicability of the $p_t^e = \alpha p_{t-1} + (1-\alpha) p_{t-2}$ formula. In the course of their examination they formed a mean of the daily closing prices of the given futures contract. The mean prices were normalised to the mean price of the month preceding maturity and carried out their calculi with the data produced in the above manner. On the basis of their results they concluded that price movements in the Budapest Commodity Exchange can be modelled with linear estimation:

„Surprisingly and despite having defined no condition for the coefficients of the previous two months' prices their sum took up a value close to 1 that is the way of thinking of market actors stands close to extrapolative estimation. After the calculus of wheat prices we conducted the computation of maize prices and we got to similar structures. Therefore we can rightly state that the relationships shown are not characteristic of the single product simply but of the exchange itself." (Lakner Z., Vizvári B. [20])

(2) The second model of their research was set up with the non-linear approximation of 537 time series of maize and wheat futures contracts. The definition of the model was carried out in many steps with the use of a great number of different functions:

„We conducted the computation for wheat. In all cases the function $p_{t-1}^{\ 3}$ was involved in the formula of estimation, and in the majority of the cases standing alone, so the valuation took the shape of

$$\alpha p_{t-1}^{\ 3} + \beta$$

where α and β are two constants. Their sum offered itself as one with good approximation without having defined any separate condition for ensuring the same." (Lakner Z., Vizvári B. [20])

Their examination was closed with the definition of an easily applicable model. Despite the fact that the number of available models exceeded 30, the setting of the final one ended with the determination of the relatively simple formula below:

$$0{,}237 p_{t-1}^{\ 3} + 1{,}392 \sin(p_{t-1}) + 0{,}732 \cos(p_{t-1}) + 0{,}04211 p_{t-2} p_{t-1}^{\ 2} - 0{,}08104 \sin(p_{t-2}) - 0{,}778$$

The authors found that the commodity exchange is a self-studying system with unique laws, the operation of which is influenced by numerous factors, though its processes can be well approximated with simple methods. As a result of their work it came out that among exchange actors a learning process takes place as the deadline is aproaching and due to which they can give a more and more exact estimate of the anticipated prices.

The overview of the Hungarian research results can be finalised with the visionary thoughts of the authors:

„The other result of our work was that we confirmed the expectations of exchange actors can be approximated with a regression function the variables of which are the contract prices of the given period or the preceding period. The contract prices of the previous two months give a relatively good description of the price expectations of the exchange actors. In the process of exchange price expectations we pointed out non-linear phenomena as well. The explanation of this phenomenon has to be submitted to further research." (Lakner Z., Vizvári B. [20])

Our research results

„In the social sciences a very important inducement of dynamical phenomena is that the expectation of different people is variable and changing. This feature of social sciences has had a significant impact on their development recently." (Muraközy B. [26])

Taking the above statement of Muraközy as starting point, during the appraisal of various research results we were led to the conclusion that the most important factor influencing the temporary change of prices is the expectation of market actors.

Though the majority of researchers support the view that in international markets information is adopted without delay in market prices and the decisions of market participants are exclusively affected by the most recent information, Hungarian research results have led to the conclusion that the postulates of the efficient market theory do not hold neither in the capital market of the Budapest Stock Exchange nor in the commodity markets of the same institution (as the Budapest Stock Exchange and the Budapest Commodity Exchange fused in 2005 we can state the same about the operation and main characteristics of the earlier markets of the commodity exchange before the integration). The investors' and merchants' decisions are featured by the cumulation of

information and the price trends are largely influenced by the adaptive expectations of actors.

Research efforts introduced in the previous parts evidently confirm that the Hungarian capital exchange trading, and the futures commodity trading therein can be fairly well modelled with empirical methods. In the case of markets which can be properly approximated with empirical methods, be linear or non-linear, random walk can not be interpreted for prices.

Through modelling we do not only gain an opportunity for theoretical classification but also for practical usage, as a result of which we can draw a relatively good picture about the processes of commodity futures markets facilitating the decision-making at the opening and closing of market positions for the applier. Naturally, the estimation does not hold out little promise for predicitions of absolute security but the analysis of markets plays by all means an important role in investors' decisions.

In the case of commodity markets the advantages guaranteed by the physical goods can reinforce our train of thought, as compared to derivative deals and stock market products the price of the traded (physical) goods can be more exactly measured here. Its quality insuring contract system predetermines a limit for the value of the product that can be proved under all circumstances. Though this value is not free from incidental market shocks (a market crisis may always occur), it can be still declared that the futures market price can not significantly fall under the market value of the produce. Defining the value of a share is not that simple, or rather there is in vain a fundamental value behind the underlying product underpinned with irrefutable proof this does not definitely exclude an undue crash in the price of the share (mainly in the case of efficient markets). Furthermore, the peculiarity of price movements in grain markets is largely influenced by its rather insignificant share in the turnover of the exchange trading.[9]

The research results supported by the analysis of the data between 1991 and 2000 provide sufficient evidence that the estimation of the grain market prices with the model of Lakner-Vizvari provides a good approximation. The opinion of the co-authors reflect the statement that during the examination of wheat and maize futures prices we can discover the same regularities. It is well presumable that, in the case of further research, both linear and non-linear extrapolative estimation can be applied for the prices of fodder wheat and maize futures.

Throughout our work, taking the above statements as basis, we were analysing the closing prices of the fodder wheat futures and the fodder maize futures between 2001 and 2005, relying on the models specified by the researchers we carried out linear and non-linear extrapolative estimations.

During the revision of the time series, though the original research did not provide such information, we did not take into consideration the results of those time series where at least five comparable elements, on the whole a time series of at least 8 elements, were not available. According to this passage 5 out of all the fodder wheat time series were excluded from the analysis. The time series of fodder maize met the required conditions in all cases.

Table 1 Correlation in the case of non-linear extrapolation

Fodder wheat data	Fodder maize data
0,798684123	0,784308099
0,7978432	0,767773819
0,757880196	0,749348672
0,652254588	0,746714853
0,526326741	0,733613957
0,510918387	0,732440325
0,441841025	0,730874376
0,387175485	0,704002395
	0,694941514
	0,676949539
	0,600406711
	0,475524768
	0,30751002

[9] For illustration it is worth comparing the data of BSE (Budapest Stock Exchange) on the turnover of September 2006 for instance: the whole turnover of the Stock Exchange (without the Grain Section) amounted to 943465,5 million Ft, whereas the Grain Section reached a turnover of not more than 2558,6 million Ft (all in all 0,27% of the previous date). At the same time in the biggest market of the former Commodity Exchange, in the foreign exchange market the traded value came out at 102247,3 million Ft. Source: BÉT statisztika 2006/09. www.bet.hu

Data for estimation was to be found among the closing prices of the Budapest Commodity Exchange released on the internet site of the Budapest Stock Exchange. We set out our analysis from the means of the monthly closing prices which were normalised to the mean price of the month preceding maturity.

In the case of the non-linear estimation, using normalized prices, we conducted our examination with the help of the given generally effective formula:

$$0{,}237\, p_{t-1}{}^{3} + 1{,}392 \sin(p_{t-1}) + 0{,}732 \cos(p_{t-1}) + 0{,}04211\, p_{t-2} p_{t-1}{}^{2} - 0{,}08104 \sin(p_{t-2}) - 0{,}778$$

(The p_{t-1} term is the closing price of the preceding date, p_{t-2} term is the closing price preceding the actual price with two periods. With the help of various functions of the two variables p_t futures prices relating to the actual date can be approximated.)

Values computed in this manner seemed to be very promising at the beginning but in some instances they did not prove to produce satisfactory results.

Among the time series of fodder wheat in 8 cases out of 20, among the time series of fodder maize in 13 cases out of 26 the value of correlation does not reach 0.8.

According to the results shown in the research of Lakner-Vizvári the formula applied to the time series between 1991 and 2000 provides a better estimation than the linear one. (Further on, we will see that this statement could not be proved with new results.)

Time series estimated on the basis of the non-linear function did not show a notable difference in their course from the time series of the closing prices.

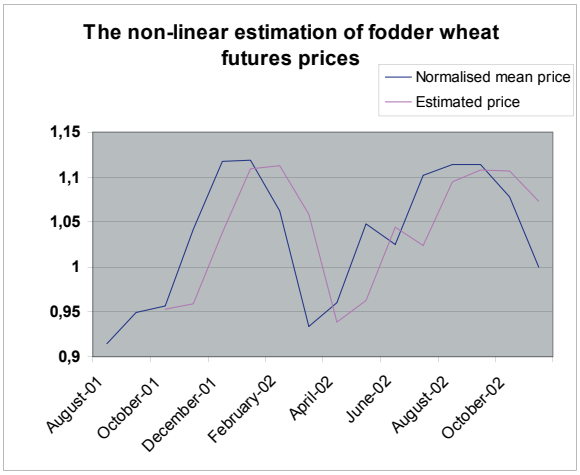


Figure 3 Fodder wheat futures December 2002

A possibility for control was provided by a shift of the estimated time series to date t-1. The diagrams below well illustrate that the course of the time series delaid in time cover the original price movements with good precision.

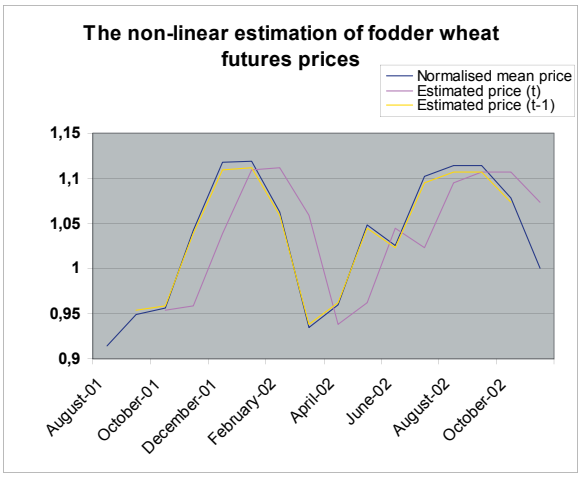


Figure 4 Fodder wheat futures December 2002

The intense similarity was underpinned by the correlation calculus as well. The correlation of the estimated time series shifted to date t-1 could be ranked between the values of 0.999 and 0.99999. By reason of the above we can state that in the province between 0.5 and 2 of the normalised data the applied model reproduces the values of the original time series with a one-month delay in time.

Following the analysis of the above results, the used formula as a model appropriate for estimation did not prove to be effective in the case of time series we took under examination.

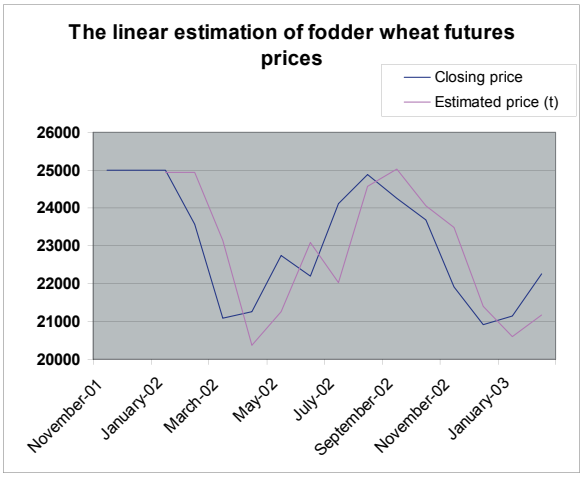
The data of the linear estimation were offered by the monthly means of the closing data processed for the non-linear calculation. The normalization of data after the refusal of the non-linear estimation was unnecessary, as for the comparison between data series it was not required. The formula for the linear model was provided by the linear regression of the SPSS 14 at a 95% siginificance level.

The approximation of the futures price valid for the given period was carried out with the help of the $p_t^e = \alpha p_{t-1} + \beta p_{t-2}$ formula consistent with the referred article, where we presumed the relationship $\beta \approx 1 - \alpha$, which means that the sum of the two coefficients should be close to one. (In the formula p_t^e denominates the estimated price, p_{t-1} denominates

the closing price of the preceding period and p_{t-2} is the closing price preceding the actual price with two periods.)

Surprisingly, the linear extrapolation gave satisfactory results. During the comparison between the real and estimated data the original time series showed a good correlation with the estimated time series for both fodder wheat and fodder maize.

The values of correlation among the time series of fodder wheat showed a value above 0.8 in 15 cases, in 12 of which superceding 0.9 among the 20 acceptable time series.



R^2	Adjusted R^2	Standard error	α	β
0.997	0.997	1261.29696	1.263	-0.265

Figure 5 Fodder wheat futures March 2003

We completed the shift to date t-1 also in the case of the linear model for revision. This helped to control – as will be demonstrated later on in the case of the three-variable model – whether the linear regression is weighed to the preceding period. Though in the majority of the cases the preceding period had a high coefficient, we can not claim that it would have influenced the uncertainty of the estimation by large. The strong weights appeared mainly in those cases where the change of the time series was even perceptibly close to a linear course.

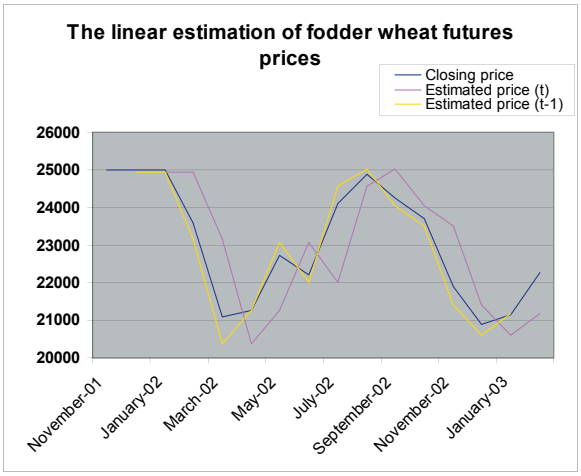
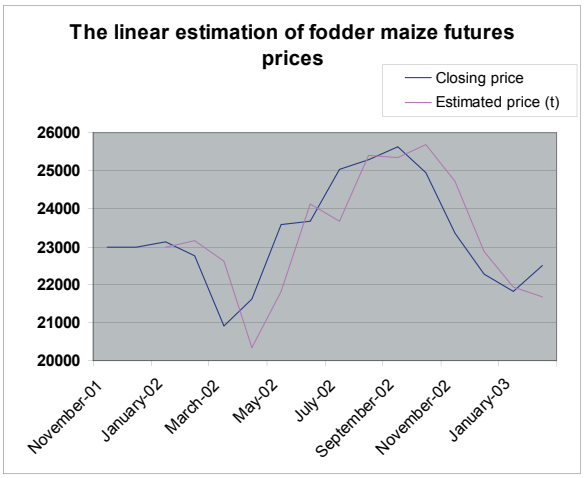


Figure 6 Fodder wheat futures March 2003

The time series of fodder maize showed a more favourable picture. The correlation of these data took a value above 0.8 in 15 cases, 12 out of which superceded 0.9 among the 26 acceptable time series.



R^2	Adjusted R^2	Standard error	α	β
0.998	0.998	1059.90688	1.292	-0.293

Figure 7 Fodder maize futures March 2003

The shift of the time series to date t-1 pointed out clearly, among the time series of fodder maize, that if price changes are linear, the value preceding the actual date takes a strong weight when using linear regression.

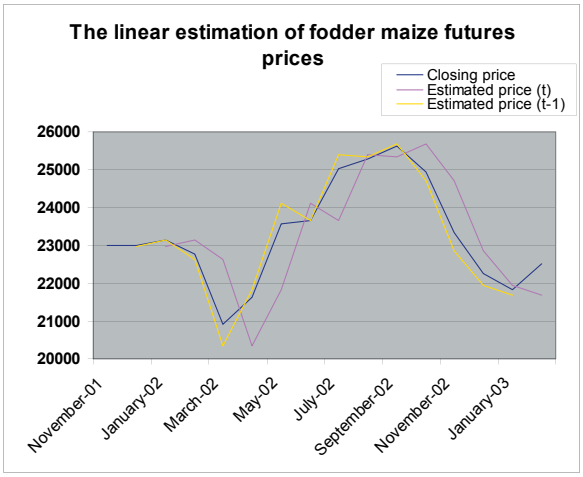


Figure 8 Fodder maize futures March 2003

Despite the strong weights for the value of the mean price of the previous month it can not be regarded as uncertainty factor thanks to the favourable correlation values. For a possible increase of the punctuality of the estimation the involvement of an additional variable for regression calculus might be reasonable.

Therefore we supplemented our examination with a three-variable linear estimation.

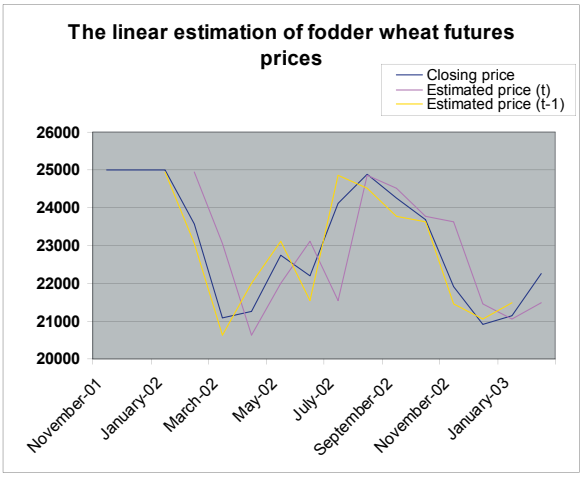
During the linear estimation with three variables we involved the mean price of the period t-3 for regression beyond the data of the two preceding periods. The formula of the linear model was provided by the linear regression of SPSS 14 at a significance level of 95%.

The formula was complemented by the term p_{t-3}.

$p_t^e = \alpha p_{t-1} + \beta p_{t-2} + \gamma p_{t-3}$ where $\alpha + \beta + \gamma = 1$

(In the formula p_t^e is the estimated price, the term p_{t-1} is the closing price of the previous date, p_{t-2} is the closing price preceding the actual price with two and p_{t-3} with three periods.) After data processing we can not unambiguously claim that it is useful to involve the mean price of t-3. The correlation values were above 0.9 in 15 cases among fodder wheat time series in 14 out of which took a value over 0.8 among the 20 acceptable time series. Though, thanks to the inclusion of the third date, there came out a very unfavourable correlation in the case of fodder wheat prices of September 2002 (0.299), the particularity and extremity of the result can not lead us to draw far-reaching conclusions.This statement seems to be especially sound if we take into account that the closing prices appeared prominently hectic in this time series.

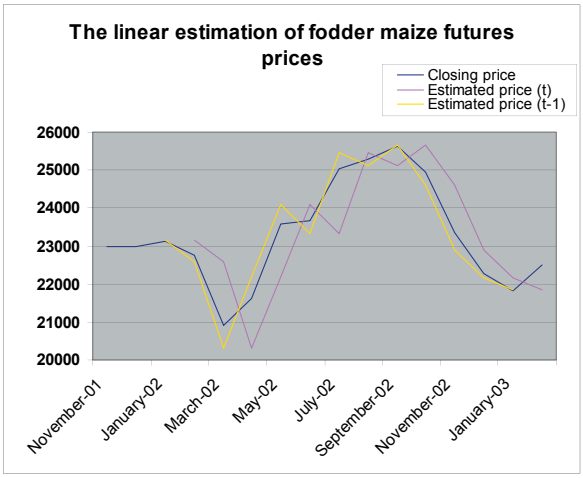
For a better comparability let us survey the courses of the regression including three variables in the same cases displaid before using the regression of the two-variable model.



R^2	Adjusted R^2	Standard error	α	β	γ
0.997	0.997	1325.58706	1.328	-0.628	0.298

Figure 9 Fodder wheat futures March 2003

The time series of fodder maize showed a less favourable picture also in this case. The correlation superceded the value of 0.8 in 12 cases and took a value of 0.9 in 12 cases within the 26 acceptable time series.



R^2	Adjusted R^2	Standard error	α	β	γ
0.998	0.998	1142.69939	1.347	-0.525	0.177

Figure 10 Fodder maize futures March 2003

STATEMENTS, CONCLUSIONS

Our present examinations, as well as, the previous Hungarian research results have yielded sufficient

evidence for the hypothetical statement which declares that the Hungarian futures commodity trading (and presumably this also holds for the Hungarian capital market) does not indicate an efficient market-like character.

a. The effectiveness of linear extrapolation evidently points out that futures trading can be best characterised with the adaptive expectation of market participants.

b. Participants bide their time with their decisions and validate their information in a cumulative manner at both the opening and closing of their market positions.

c. The statement seems to be valid for not only the Hungarian markets but for all exchanges in the emerging countries of Central and Eastern Europe. These countries are lagging behind not only with respect to their capital and commodity markets. The economy of these countries shows a great deficiency in capital which considerably and strongly affects the functioning of markets without a siginificant foreign participation in the commodity and capital markets.

d. A notable change can solely be achieved through the enhancement of liquidity. The integration of the Budapest Stock Exchange and the Budapest Commodity Exchange was a major step in this direction though we have to mention that the fusion did not contribute to the strengthening of wheat trade in the commodity exchange market. The new institutional built-up had before all an important impact on the operation of the foreign exchange market which accounts for a great part of the daily turnover of the Budapest Stock Exchange through a wide range of trading possibilities.

The markets of the developed economies having integrated the exchanges of more countries by now operate with a high liquidity. The international integration of commodity and capital markets with low liquidity – like those of Hungary – is inevitable mainly from a regional perspective.

The examination focused on those futures trade contracts of the grain section which have – at a world-wide scale negligible but – in the home markets the greatest turnover. Though the results confirmed the initial hypothesis we did not get any answer to some questions which are relevant considering research in this field.

Does the trade of futures contracts have a dominant impact on the Hungarian grain trade?

Do market participants take advantage of the incontestable vantages of futures trade?

What role does the grain futures market play in the deals of economic actors aimed at price-insurance?

How often do economic actors make exchange deals with the same purpose?

We could define a great number of similar questions further on. The most important goal, however, is to inform market actors and to change their image. Thus an efficient futures market is unimaginable without a sufficient number of participants.

The economy, or rather the actors of the agrarian economy do not show due interest towards the opportunities offered by the grain market. The current state of trading in the commodities section of the stock exchange should be improved with adequate information, orientation and the application of marketing tools

For a better contrast it would be expedient to similarly evaluate the prompt and currency futures market in Hungary. With the help of the currency market research results (due to their more developed nature) it would be possible to make a predicition about the future changes of the commodity market and the prospective consequences.

It is worth continuing the already initiated integration process – as the news about such plans trumpeted in the media some years ago have not been followed by practical steps – which would be necessary from the point of view of the development of the Hungarian markets, as the upsurge of grain markets is inconceivable without a rise in volume and liquidity.

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