Expectations theory and wheat price dynamics

Teorie očekávání a dynamika vývoje cen pšenice

D. Shiyan[1], Y. Babochkina[2]

[1]*Kharkiv National Agrarian University, Kharkiv, Ukraine*
[2]*Technical University of Munich, Germany*

Abstract: The analysis of prices on wheat in Germany from the point of view of the theory of expectations is given. For this purpose, the authors propose their own method of data processing which is called the method of sliding expectations. Different variants of its application were tested for the prognosis of the future meanings of the dynamic line. The conclusion is made as to the proposed methodology that permits to increase the prognosis authenticity. The treatment of the primary data of dynamic lines by sliding expectations allows to make their character closer to the stationary ones and to use it in the future analysis.

Key words: theory of expectations, prognosis, prices on wheat.

Abstrakt: Příspěvek představuje výsledky analýzy vývoje cen pšenice v Německu z hlediska teorie očekávání. Autoři pro tento účel navrhli vlastní metodiku zpracování dat nazvanou metoda klouzavých očekávání. Různé varianty této aplikace byly testovány pro účely prognózování budoucího významu dynamické řady. Z toho ve vztahu k navržené metodologii vyplývá závěr umožňující zvýšit prognostickou autenticitu. Zpracování primárních dat dynamické řady metodou klouzavých očekávání umožňuje přizpůsobit jejich charakter statickým řadám a využít je pro analýzu budoucího vývoje.

Klíčová slova: teorie očekávání, prognóza, ceny pšenice

With an increasingly wide usage of computer technology in the last decades, various analysis methods have been gaining still larger implementation scope, those considering dynamics being one of the most popular ones. Arguably, this can be tracked back to the natural feature of individuals to draw conclusions about a specific phenomenon based on dynamic observation of the latter. Practically, the mankind has been mounting knowledge in this very way, passing it over to the next generations. For instance, as many scientists suggest, the high level of the astronomy science in the Ancient Egypt and Sumer civilization was by and large due to the thousands of years of constant observations.

The modern information society makes it possible to receive and process large volumes of information with nearly no timing lags. For instance, think of data of the world's major exchanges. Therefore, the right timing and adequacy of the decision-making process has become of still greater importance. In order to mitigate the probability of mistakes, analysts usually use different methods of input data procession.

MATERIAL AND METHODS

In our opinion, the term "expectation" in economics stems from the so-called subjective psychological framework, founded by W.S. Jevens. He was the first scholar to consider utility from the psychological point of view, associating it with pleasure (Jevens 1957). This perspective received its further development. L. Mises regarded marginal utility as perceived value (Mises 1957).

Transition from the merely psychological economic perspective on this issue towards regarding it in the terms of expectations was by and large due to the paper "Industrial fluctuations" by A.C. Pigou (1927), according to which fluctuations could be explained by psychological peculiarities of individuals. A.C. Pigou associated such fluctuations with changes in mindsets, which, in turn, result from the comparison of real and expected incomes. This framework was considerably extended by J. Keynes's "The general theory of employment and money" (Keynes 2002). According to Keynes, "... the facts of the existing situation enter, in a sense disproportionately, into the formation of our long-term expectations; our usual practice being to take the existing situation and to project it into the future" (p. 141). From this standpoint, the author defines marginal capital efficiency in the following way: "… the marginal efficiency of capital is here defined in terms of the expectation of yield and of the current supply price of the capital-asset". Above and beyond, fluctuations in marginal capital efficiency, and thus those of the expected incomes, directly influence cyclical development of the economy: "The Trade Cycle is best regarded, I think, as being occasioned by a cyclical change in the marginal efficiency of capital". J. Robinson summarized these theses of the Keynesian theory as follows: "for me, the term "post-Keynesian" refers to economic theory or analysis method, which takes into account the difference between current and future points in time" (Robinson 1978).

This theory was further elaborated by A. Shackle (1957, 1972, 1983–1984). According to him, every point of time is unique, causing uncertainty of the future. As a result, realized and unrealized expectations can be associated with certain dates, which, in turn, allows for establishing a link between today's and tomorrow's events. Thus, one of the principal points of this theoretical construction, apart from the expectations, is time as an independent category.

This paper will not touch upon the latter, since it is beyond the scope of our focus. But it is worth noting that time as an independent category has been receiving an increasingly extended attention from different theoretical perspectives (Vosnaja 2005; Peters 2000).

RESULTS AND DISCUSSION

Based on everything said above, it can be stated that expectations – in quite diverse interpretations - constitute nowadays one of the principal problems in economic science. In this paper, we decided to apply this approach to only one process, namely the dynamics of prices on premium wheat in Germany. In doing so, we have applied our new approaches to the dynamic rows analysis.

In order to present the logics of the suggested approach, consider the following example. Consider that the wheat price changes along the following pattern: 2, 3, 4, 5. Based on the provided pattern, analysts may draw different conclusions. Some will assume that the next number should equal 3, other will assume 6 to be the relevant number, while the rest will pick 4.5. In this case, the first group can be regarded as "pessimists", the second group as "optimists", while the third one can be regarded as "the pragmatic". Which of the groups is right depends on the real value of the future wheat price in the pattern row provided above. Under the given circumstances, assumptions of each of the groups can be justified. Practically, in our example decisions of every individual to a large extent depend on the psychology and experience of this individual.

In our opinion, the latter can be described by specific functions. For this purpose, we decided to

Table 1. Alignment of input data according to linear, polynomial and exponential functions

Input data	Derived equations			Deviations from actual values		
	$y = 6.47-0.194x$	$Y = 6.37-0.025x^2$	$y = 6.35e^{(-0.030)x}$	$y = 6.47-0.194x$	$Y = 6.37-0.025x^2$	$y = 6.35e^{(-0.030)x}$
5	6.27	6.34	6.16	–1.27	–1.34	–1.16
6	6.08	6.27	5.98	–0.08	–0.27	0.02
4	5.88	6.14	5.80	–1.88	–2.14	–1.80
7	5.69	5.97	5.63	1.31	1.03	1.37
5	5.50	5.74	5.47	–0.50	–0.74	–0.47
9	5.30	5.46	5.30	3.70	3.54	3.70
7	5.11	5.14	5.15	1.89	1.86	1.85
6	4.92	4.76	4.99	1.08	1.24	1.01
2	4.72	4.33	4.85	–2.72	–2.33	–2.85
3	4.53	3.86	4.70	–1.53	–0.86	–1.70
Coefficient of determination (R^2)	0.081	0.173	0.068	–	–	–

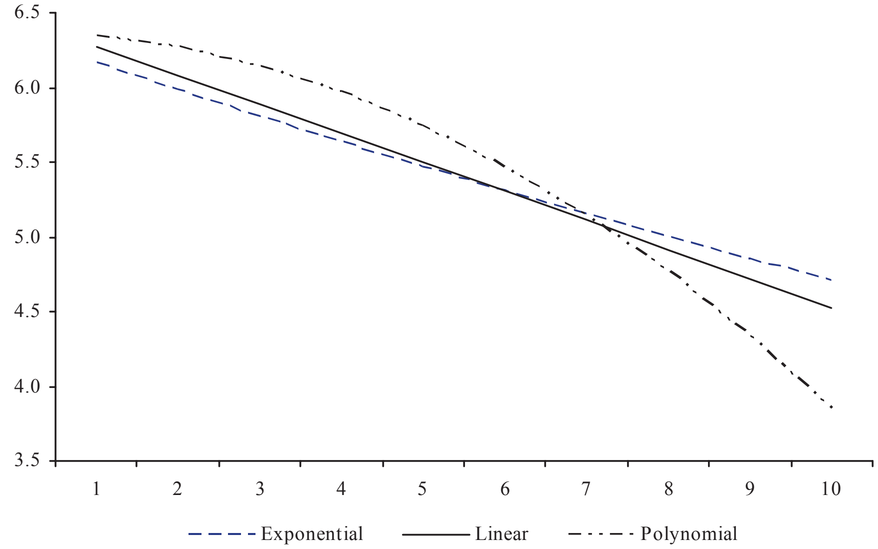

Figure 1. Alignment of input data along selected types of functions

use exponential, linear and polynomial functions. Mathematically, this translates into the following equations respectively:

$y = a_0 + e^{a1x}$

$y = a_0 + a_1x$

$y = a_0 + a_1x^2$

Let us consider their implications for the given example (Table 1, Figure 1). The first one is the sign of the deviation of the function values from the input data. In all the cases, they were identical. However, it is important to see how significant these deviations were, i.e. to what extent the derived values were adequate to the input data. Whereas there is a number of methods to evaluate the latter, for our case we opted to use the coefficient of determination.

Based on the derived values, it can be stated that none of the curves reflects the dynamics of the actual data well enough. However, the most precise values were provided by the polynomial function, while the least precise ones by the exponential one.

Based on everything said above, the following needs to be emphasized. In our example, the group of analysts with a mindset corresponding to the polynomial function would make the most precise forecast, while

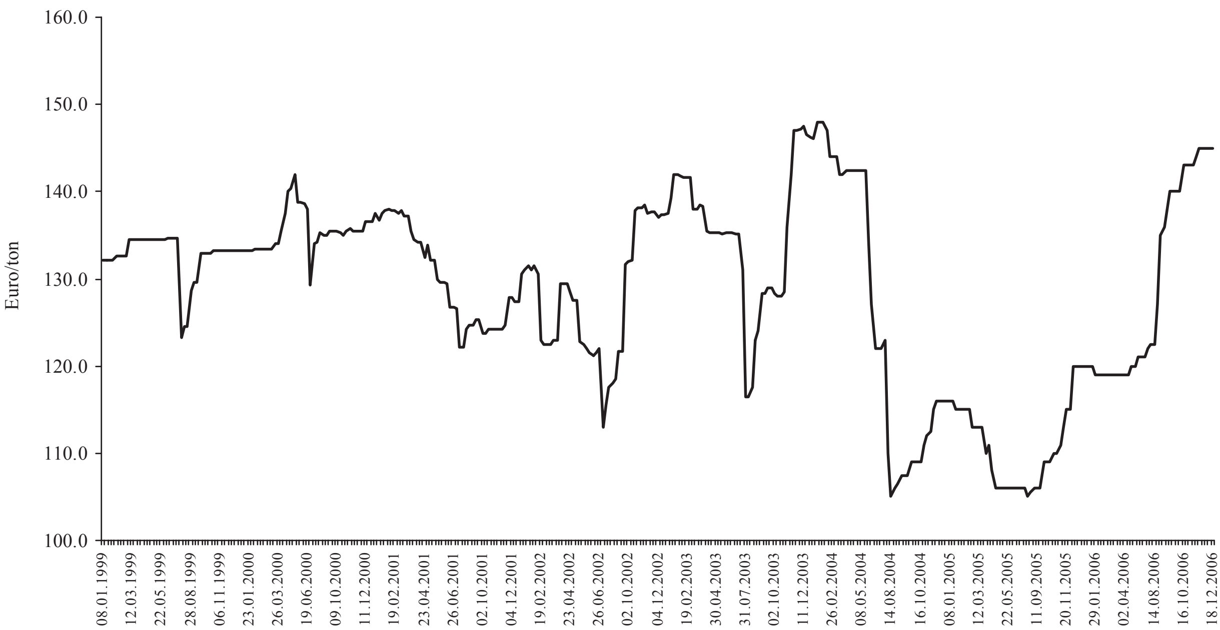

Figure 2. Dynamics of the price change for premium wheat in Germany, 1999–2006

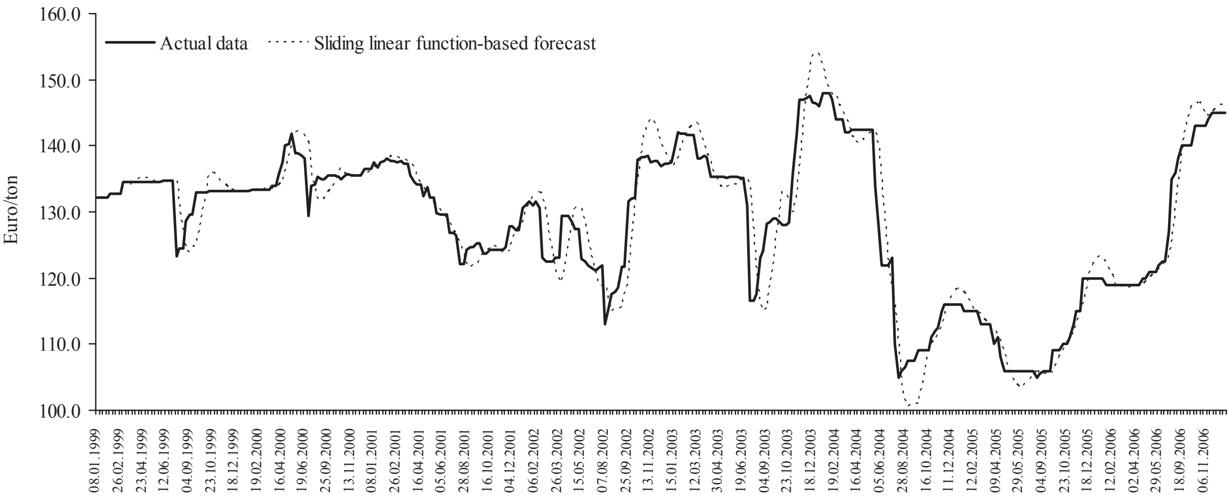

Figure 3. Dynamics of the actual prices for premium wheat in Germany and prices, forecasted based on sliding linear function, 1999–2006

the least precise one would be made by the group of analysts with a mindset akin to the pattern of the exponential function. As the Figure 1 shows, the most precise forecast would be made by the analysts with a more optimistic mindset rather than those corresponding to the rest of the functions, while the least precise forecast would be due to the analysts with a less optimistic mindset than that of the rest. The second group of analysts, in our example, would make an erroneous forecast, which would lead to incorrect actions.

Then, how can the described approach to data analysis be put into practice? A simple alignment of price dynamics along the given function has been used for a while now, but it does not provide an answer to the posed question. In order to solve this problem, we suggest an approach of a sliding window, which we used to calculate sliding velocity and sliding expectations (Shiyan, Babochkina 2006; Shiyan 2006a). Practically, this methodology of estimating the latter – with some modifications – was used in this case as well. The actual effectuation was conducted in several stages.

At the first stage, the input data of the selected time period were aligned according to the identified functions. As has been emphasized above, we opted to use three types of functions. However, in more general terms, any function type can be used. At this stage, the duration of the chosen period is of great importance. This issue has to be solved with regard to the specific circumstances. If the objective is to analyze market fluctuations in prices, the window length should be insignificant (5–6 periods). If the middle- and long-term trends are to be identified, the window length should be more significant (10–20 periods).

At the second stage, based on the derived function equation, the forecast is to be made for the following period in the future. Thus, it has to be assumed that the mindset of the decision-maker is predetermined by the previous events (periods of time). The core question here is what kind of mindset that is.

At the third stage, the window determining the function has to be moved one period forward, while the whole process is repeated. Ultimately, one has to estimate the adequacy of the obtained outcomes, as well as to decide which trends dominate in the dynamics of the process in focus.

As the subject to our analysis, we chose price dynamics of premium wheat in Germany in 1999–2006 (Figure 2). The given dynamic row includes 343 time points with an interval of approximately one week.

Table 2. Mean values of sliding coefficients of correlation between the actual data and the forecasted values by different functions

Year	Functions		
	exponential	linear	polynomial
1999	0.280	0.279	0.295
2000	0.272	0.273	0.325
2001	0.539	0.539	0.573
2002	0.516	0.513	0.604
2003	0.378	0.377	0.450
2004	0.626	0.634	0.655
2005	0.616	0.615	0.650
2006	0.673	0.694	0.641

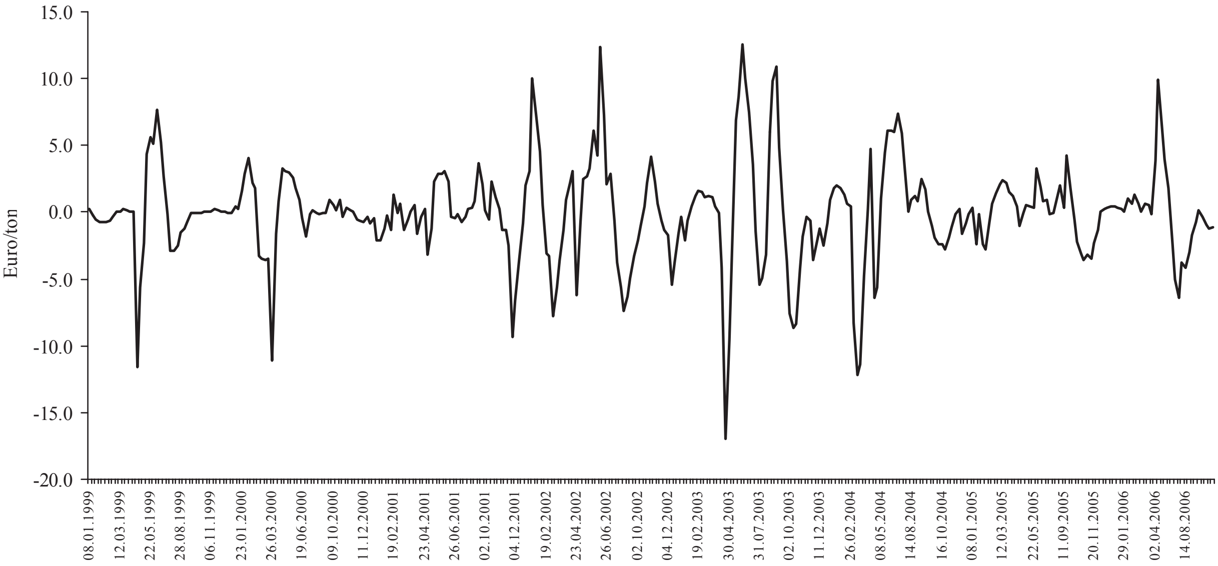

Figure 4. Dynamics of differences between sliding linear function–based forecast prices and the actual prices for premium wheat in Germany, 1999–2006

However, some of the chronological data was not fully available. For instance, July data through all years are missing, moreover, at some points the sequence lacks some of the data for certain weeks. Nonetheless, the figure provided below shows that the price for premium wheat is of a cyclical nature. While the minimum price value is reached in August, the maximum values through the years are reached at diverse points. For instance, the local maximums fell onto January, February, May and November. The spectral analysis conducted showed that in this dynamic row, the most pronounced period – although not too distinctly- is the one of 49 weeks (i.e. almost a year), which is quite foreseeable and logical.

The next stage was associated with implementing the approach described above. As a result, three new curves, closely related to the input data, were derived. For the purpose of simplicity, we shall only provide the curve derived by applying the sliding window forecasting based on the linear function (Figure 3). In order to identify the differences between the forecast results based on different functions, we calculated

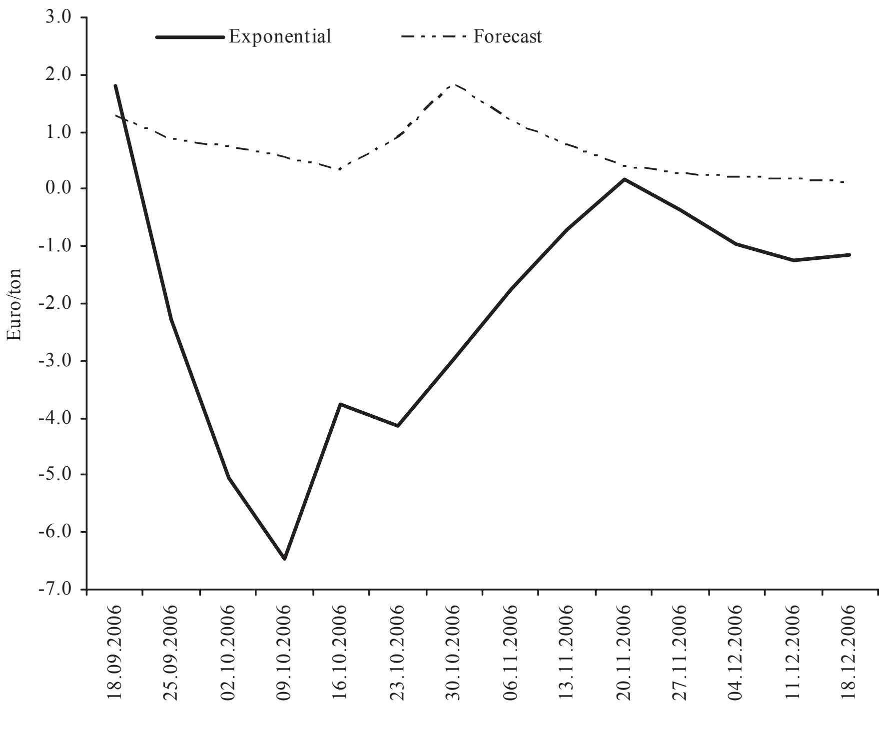

Figure 5. Dynamics of differences between the forecasted and actual prices for premium wheat in Germany, 2006

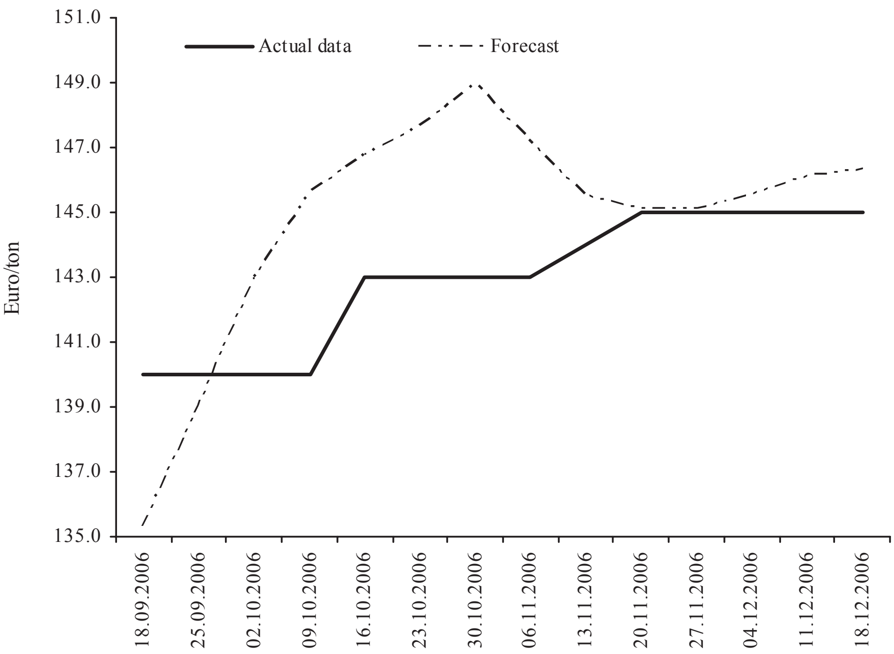

Figure 6. Dynamics of the actual and forecasted prices for premium wheat in Germany, modified by differences of the relevant values based on exponential function

the correlation coefficients between the relevant values provided by different functions and the actual data. In doing so, we maintained the window width of 10 periods. As a result, the dynamic row in focus decreased by 10 more periods. The results of the calculation are provided in the Table 2.

The data provided above drive us to the conclusion that in certain years the logics, underlying the price dynamics, and thus the actions of the relevant market actors, influencing the price dynamics, developed according to different scenarios. Whereas in 1999–2000 the dynamics only somewhat depended on specific functions, in 2004–2006, as the coefficients of correlation indicate, the dependence was much more significant.

However, it is worth noting that all of the coefficients had a very little variation. The latter is due to the fact that the chosen functions were similar, and the definition domain of the periods was quite narrow. Overall, through all the periods, the mean value of the sliding coefficients of correlation equaled: 0.514 for the exponential function, 0.517 – for the linear function, and 0.553 – for the polynomial function. This fact indicates that the trend of price dynamics, predetermined by the polynomial function, was the prevailing one.

The analysis of the differences between the forecasted and actual values appears to us to be a very interesting aspect as well (Figure 4). The graphical representation of the dynamics of these differences drives us to the conclusion that they characterize a dynamic process, close to a stationary one or the so called white noise. The latter fact is also supported by the insignificant correlation in the dynamic row, as well as the distribution, close to normal. Therefore, for a simple forecast of the change, the auto-regression function (ARIMA) can be used. The results of the forecasted values of 14 differences, as well as their actual values, are provided in the Figure 5. However, the minimum value of the sliding deviation was not forecasted, since significant deviations from the trend are always hard to forecast, not only mathematically, but also by common sense. Expert knowledge can hardly solve this problem.

We also find it reasonable to use this forecast in order to modify the derived values of sliding expectations based on the relevant function. This means that each of the made forecasts has to be modified by the forecasted value of the relevant difference, which, in turn, contributes to the reliability of the forecast (Figure 6).

Thus, the resulting forecast can be regarded as a rather trustworthy, reflecting the actual change of the price. This is also supported by the value of the coefficient of correlation between dynamic rows in focus (the coefficient equals 0.592). The latter exceeds the respective value derived based on the exponential function (which equaled 0.495). The same holds true for the other two functions used. For instance, with the introduction of the above mentioned modification, the correlation coefficient for the linear function increased from 0.575 to 0.633, which for the polynomial function was especially substantial: from –0.109 to 0.425. Thus, it can be stated that the suggested approach allows for improved reliability of the forecasted values.

Perhaps other types of functions (parabolic or sinusoidal) could augment the values of correlation coefficients, and thus, obtain yet more reliable results. However, the objective of this paper was to outline the framework of the new approach to data analysis as such, while the obtained values made it possible to draw some important conclusions.

REFERENCES

Jevons W.S. (1957): Theory of political economy. New York.

Keynes J. (2002): The general theory of employment, interest and money. Galois ARV.

Mises L. (1957): Theory and History. Yale University Press, New Haven.

Peters E. (2000): Haos na rynkah kapitala. Noviy analitizeskiy vzgljad na zikly, zeny i izmencivost' rynka (Chaos on the capital markets. New analytical insight into the cycles, prices and market volatility). Mir, Moskva.

Pigou A.C. (1927): Industrial fluctuations. Macmillan and Company, London.

Robinson J. (1978): Keynes and Ricardo. Journal of Post Keynesian Economics, 1 (1): 12–18.

Shackle G.L.S. (1957): Time in economics, North-Holland Publishing Company, Amsterdam.

Shackle G.L.S. (1972): Epistemics and Economics. Cambridge University Press, Cambridge.

Shackle G.L.S. (1983): The romantic mountain and the classic lake: Alan Coddington's Keynesian economics. Journal of Post Keynesian Economics. 6 (2): 241–251.

Shiyan D., Babochkina Y. (2006): Vplyv faktora ozikuvan' na zminu zin zernovyh ta sonjashnyku v Zaporiskiy oblasti (Impact of expectations on price change of grain-crops and sunflower seeds in Zaporozhskaya Region). Zbirnyk naukovyh praz' LNAU, (62/85): 220–224.

Shiyan D. (2006): Ispol'zovanie prinzipa ogidanij v analize dinamizeskih rjadov (Implementation of expectations principle in analysis of dynamic rows). Rynok zennyh bumag, (3): 78–80.

Shiyan D. (2006): Ozenka dinamiki akyij metodom skol'sjashej skorosti (Evaluation of shares dynamics based on sliding velocity method). Rynok zennyh bumag, (6): 15–18.

Vosnaja L. (2005): Fisika vremeni v prognosirovanii finansovyh katastrof (Time physics in forecasting of financial crises). Voprosy ekonomiki, (8): 27–40.

Arrived on 17th May 2007

Contact address:

Dmitriy Shiyan, Kharkiv National Agrarian University, Komunist-1, Kharkiv Region, 62483, Ukraine
Yuliya Babochkina, Technical University of Munich, Alte Akademie 14, 85350 Freising-Weihenstephan, Germany
e-mail: dm_shiyan@rambler.ru; babochka211@gmail.com