UDC 339.722:519.865

Mikhail Kussy,
Cand. of econ. sci., assistant professor, Taurida national V.I. Vernadsky university

INTRODUCTION INTO APPLIED THEORY OF CURRENT VOLATILITY

The concept of the current market volatility as a new economic category is discussed in this article. The fundamental differences of the proposed market characteristics are compared with the existing types of volatility. The author offers a new methodology for current volatility use in the forecast modeling of price dynamics in financial markets. The effectiveness of current volatility to analyze and forecast the behavior of the socio-economic systems is demonstrated.

Keywords: volatility, current volatility, market reflexivity, forecast modeling of price dynamics in financial markets.

INTRODUCTION

The globalization of financial market has promoted the increase of the interest in trend analysis and forecast models, and in the development of investment strategies by the financial market participants.

The development of methodological approaches, which give qualitative and quantitative characteristics of financial market mechanisms in order to analyze and forecast the price dynamics, is referred to as one of the most important tasks in researching such systems.

The world theory and practice in conducting analysis of financial market behavior haven't elaborated a universal approach in determining the essential characteristics of these socio-economic systems.

The nature of price changes in financial market depends, at least, on two components of the price formation process that is on the deterministic component, which displays fundamental processes in economy and which takes into account «market memory», and on the casual noise, which reflects the «mood» of a market and has a short-term influence.

By «casual noise» we understand market volatility. Volatility is one of the most important characteristics of urgent financial market. It's a risk indicator that characterizes the degree of the asset price variability during a definite time period.

PROBLEM DEFINITION

The main aim of the article is to distinguish the problems of current volatility.

RESULTS

Volatility as an important characteristic of financial markets

At one time the research of volatility was encouraged by unsatisfactory quality of cycle analysis conducted on capital markets when it was not possible to predict the volatility level in intraday time scale that has led to inadequate analysis results. Moreover, it has been noticed that cyclical analysis operated more or less satisfactory in investment horizons with its «time nominal» of a month or a week but it failed in shorter periods of time. We believe that the reason for such a problem is the shortcoming of the methods used to calculate the market volatility (see below).

Volatility as a measure of market instability has a great influence upon behavior changes of trends as well as of economic agents themselves. It characterizes the size of possible fluctuation rate of the financial instrument price for the selected period of time. The failure to take volatility into account greatly distorts the results of the market processes analysis as it is shown in [1].

High volatility in financial market increases accumulative investors' interest in such a market. Low volatility reduces the interest of economic agents in such a market as the amount of the expected reward from operations decreases as well. It means that the reduction of volatility in financial market for a long period of time (for investment horizons with its «time nominal» of one day or more) is usually accompanied by participants outflow from this market.

Market volatility is generally measured in units of standard deviation y. Market volatility is considered to be proportional to the square root of the time of observation. Indeed, according to the statistical nature of the market, the closing price of almost any of its highly liquid financial instrument for an intraday random horizon can be described by Gaussian distributions [2, p. 27].

«However, numerous investigations of financial markets that have been held over the past ten years have shown that in fact the market volatility exhibits the following characteristics:

1. With time market volatility increases faster than the square root of time.
2. In various financial market segments volatility acts differently» [2, p. 56].

As a rule several types of volatility are used when analyzing market price dynamics. Different volatility types and formulas for their calculation are presented below.

1. Historical volatility [3, p. 40]:

$$HV = \sqrt{\frac{\sum_{i-1}^{n} u_i^2}{n-1} - \frac{\left(\sum_{i=1}^{n} u_i\right)^2}{n(n-1)}} \times \sqrt{253}, \quad (1)$$

where U_i is the natural logarithm of relative price change S_i:

$$u_i = \ln \frac{S_i}{S_{i-1}}.$$

Historical volatility is an integrated range of the price fluctuations over a certain period of time in the past (usually over one year) used to forecast the price behavior in the future.

2. Parkinson volatility [3, p. 41]:

$$PV = \frac{0{,}627}{n} \sum_{i=1}^{n} \log \frac{max_i}{min_i}, \quad (2)$$

where max_i and min_i are the maximum and the minimum of price value for i-th time period Δt accordingly.

As one can see from Parkinson volatility formula, it is calculated for n periods of time Δt and it also takes into account the history of the process.

3. Chaykin volatility [3, p. 41]:

$$ChV = \left(\frac{EMA(Range)}{EMA(Range\_n\_periods\_back)} - 1 \right) \times 100, \quad (3)$$

where EMA (Range) = λ Close (Range) + $(1 - \lambda)$ Close (Range – Δt);

λ is a smoothing parameter which value is calculated subjectively, $0 < \lambda < 1$.

Chaykin volatility uses in computation relative value; when calculating relative value n time periods Δt are used in order to consider the process history as well.

4. Realized volatility:

Realized volatility is the standard deviation of adjacent 20-day increments S_i. These increments are non-overlapping and independent [4, p. 146]:

$$RV_n = \frac{\sum_{t=1}^{n} (S_i - \bar{S})^2}{n-1}, \quad (4)$$

where $\bar{S}$ is an average value S_i.

There are many views on understanding the concept of volatility as well as approaches used to calculate it. However, volatility is calculated taking into account the price series for a long period of time that leads to introduction of the «aftereffect» influence into calculation of volatility results: the event has happened «a long time ago» but its impact on «the current» market process can still be seen. The above-mentioned examples show that volatility is considered as an integral characteristic of price dynamics although as a rule it is used for current forecasts of future prices in capital markets. Thus, such a discrepancy contributes inconsistency to the whole process of volatility calculation and its use.

Besides, there is a certain ambiguity in interpreting the concept of volatility when developing programs that are used in dealing centers. Thus, the software product Omega Research Prosuite 2000i ver. 5/00/0822 designed in 2001-2002 by Trade Station Security Inc. and installed in the dealing center of the Crimean Republican branch of «Ukrsotsbank» has at least three different instruments of technical analysis (Volatility, Volatility Extreme Value, Volatility Standard Deviation), which interpret and calculate volatility in different ways.

All aforesaid allows to draw a conclusion about the urgency of the study of volatility when analyzing financial market trends. The meaning of volatility as a category, which is used when analyzing the market process, also needs clarification, taking into account the made-above comments.

Market determinism, which is reflected in the calculation method of the above-mentioned volatility types, is not always important for the economic agents who work in financial markets. Moreover, the

dynamically changing market trends often lead to the necessary reduction of the depth of a retrospective review when making the preforecast price dynamic analysis. Especially when one considers that the current trade in financial markets is conducted in real time (often in the depths of the intraday investment horizons), and for the most investors the current trends in prices are more important than what was in the «last month».

Moreover, social-economic systems are chaotic (see for instance [5]). This means that the development path of such a system has many bifurcation points that also lead to necessary reduction of retrospection depth in order to increase the adequacy of the current analysis and the forecast of the financial market processes.

The existing discrepancy in the use of the standard deviation when calculating volatility also requires a more careful study. Many works (see for example, [2, 5-11]) consider financial markets to be deterministic systems and casual fluctuations to be a sign of stochastic (nondeterministic) systems. Therefore in order to increase the adequacy of practical analysis and forecasting of price dynamics in financial markets one should use the mathematical apparatus, in which the instruments of stochastic analysis would not have been used.

Consequently, a more precise definition of volatility should be introduced. It will more accurately reflect the contents of market variability, which, as a rule, has a short-term influence upon the price dynamics in financial market.

Reflexivity as a significant characteristic of financial markets

The existing concepts, theories and certain investigations do not give the only answer to the question of how to improve the effectiveness of the economic agent activity and, therefore, what one should do in order to receive high guaranteed trading results in financial markets.

According to George Soros, an economic agent makes certain investment decisions in financial market taking into consideration the expectations of participants. George Soros also says that expectations regarding future prices are the basis for motivation in speculative transactions with a capital [12. 42]. Under «speculation» in this case one should understand the transaction in buying and selling financial assets in order to profit from price changes, provided that it is hard to predict future price changes.

George Soros describes reflexivity as a mechanism of bilateral feedback between thinking and reality, between decisions made in the present and future events that is the interaction generated by this bond [12, p. 50-52]. Market reflexivity means that our thinking actively influences the events in which we either participate or think about. The concept of reflexivity reflects the social nature of the financial market. The market is formed by people who also actively participate in the price formation. That means that economic agents are members of a socio-economic system, which is the financial market. However, in real time they actively influence the system, reflecting their expectations in quotations, which, in its turn, affects the change of the current trend.

Thus, he argues that the future of the trend dynamics of financial market depends on the way the market participants assess its future developments (What predictions, preferences, expectations of market participants are there?) [12, p. 36].

It should be understood, however, that these preferences and expectations of various economic agents who trade in the same financial markets are different from each other. This depends on:

- the level and speed of perception of market information by an individual;
- the qualification and the experience of an economic agent;
- the investment strategy and the amount of investment resources which are at the agent's disposal;
- the psychology of a subject (a participant of the sale in financial market);
- whether an agent has his/her individual thinking stereotypes and paradigms;
- etc.

The factors mentioned above do not exhaust the entire list but they are important for understanding the importance of taking into account the development of reflective approaches to analyzing and forecasting the price dynamics in financial markets.

At the same time in the market there are economic agents who have a variety of investment strategies that reflect the interests of market participants in different time intervals. Individual investment preferences and expectations as well as subjective features of psychology compel economic agents to make transactions, taking into consideration the deliberately filtered (according to the individual investment strategies and paradigms) market information. In this case, the difference in selecting information causes various quotes to appear, which are the results of market expectations from specific individuals who trade in financial market.

Thus, the current financial market price is an integrated result of these individual reflexive influences on the price dynamics from all economic agents who are simultaneously working in the market.

Therefore one should consider the reflexivity when forecasting trend modeling in financial markets in real time. Hence there is a need to develop new appropriate tools, which would take into account market reflexive processes.

Current volatility as a measure of market reflexivity

In order to solve some problems listed above we encourage to use the current market volatility index, based on a fundamentally different methodological approach.

Prices in financial markets are available to economic agents in the form of a four-time series: $P_{\Delta t} = \{Open_{\Delta t}, High_{\Delta t}, Low_{\Delta t}, Close_{\Delta t}\}$, where Δt is the time interval during which the price dynamics is characterized by the opening price $Open_{\Delta t}$, the highest price $High_{\Delta t}$, the lowest price $Low_{\Delta t}$ and the closing price $Close_{\Delta t}$. These four prices are involved in the formation of the so-called Japanese candlestick (see Fig. 1) and integrally reflect the expectations of market participants concerning the future price dynamics during the interval Δt.

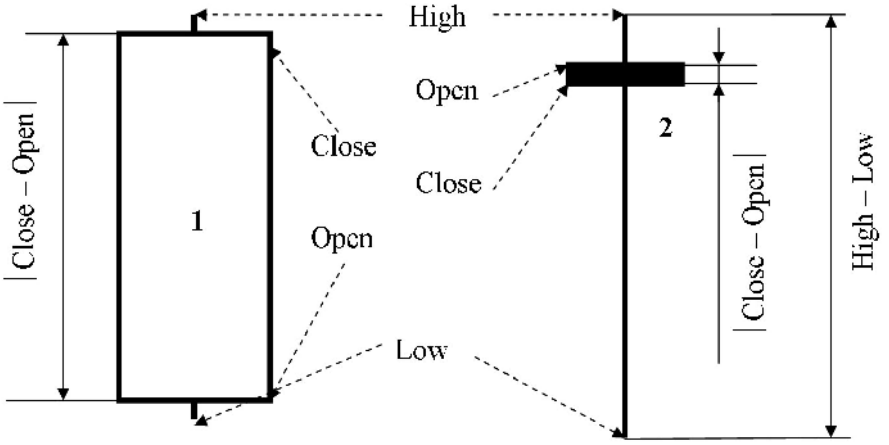

Fig. 1. Graphical interpretation of VM factor (Compiled by the author)

Taking into account the considerations given above, the rate of current volatility VM (mean «Volatility Momentum»), which reflects the current trends in financial markets, will be calculated the following way:

$$VM=\frac{High-Low}{|Open-Close|}\geq 1 \qquad (5)$$

If the denominator of the formula (5) is 0, use the formula (6), which is a special case of (5):

$$VM=\frac{High-Low+\varepsilon}{\varepsilon}, \qquad (6)$$

ε is an amount, which is less than the amounts used in calculation. In our case, $\varepsilon = 1/10$ of point quotation used in a particular financial market. That means that ε is at least 10 times less than any price value involved in the calculations.

Formula (5) determines in how many times the height of the «body» of candles in [Open, Close] price range is lower than the «shadows» of the same candles in [Low, High] price range (see Fig. 1). In other words, how many times the expectations of economic agents about the future price trends during the current trend along the line Open $\rightarrow$ Close were different from the expectations of market participants, whose investment decisions varied from the current trend towards High and Low.

Formula (6) is designed for candles that have |Open – Close| = 0 (i.e., the «body» of the candle in the range of [Open, Close] has a zero height), and allows us to distinguish to what extent the value of VM is different for candles with different geometry of «shadows» (the part of the candle which remains outside the «body» of the candles). For example, the «body» of the candle number 2 (see Fig. 1) has almost a zero height. Usually candles with such a «body» appear on computer monitors of bidders when there is a change in the current trend or its correction. That is the reduction of the «body» size of the current candle

while its «shadows» is growing (that happens to the candle number 2) sends a signal to bidders that the current trend reduces the rate of its growth. In contrast, the candle which «body» is larger than its «shadow» (the candle number 1 in Fig. 1) «reports» bidders that the current trend has been formed and most likely it will be kept the same.

It must be said that approaches in defining market volatility, which had existed before the current volatility index was formed, had worked as a predictive indicator of the market quite unsatisfactorily.

The socio-economic sense of indicator VM is that this figure shows to what extent the trend, which is working within the study period Δt along the line Open $\rightarrow$ Close, becomes risky (unpredictable in its dynamics) to continue trading. The candle configuration differs from the candle box without a «shadow» (Fig. 1) at the expense of transactions, the prices of which differ from the general trend (in the price range [Open, Close]) in the direction of High and Low. VM shows how the common trend (in price range [Open, Close]) may differ from the views of any economic agent operating in the analyzing market. That is in what way the view of market participants, who are involved in shaping the current trend along the line Open $\rightarrow$ Close during the time period Δt (in price range [Open, Close]), may differ from the views of other market participants who have signed the deal at a price deviating in the direction of High and Low.

The higher the VM indicator, the more different are the views of market participants about equivalence of the current price for the monitoring, over the specified period of time Δt, an asset to the current trend. Once the value of the VM indicator starts to exceed 1 significantly, it means that the total length of the «shadows» is substantially longer than the «body» of the candles. Studies have shown that this occurs when the market has a side or a sluggish current trend, and the views of economic agents about the future of price dynamics are contradictory. Hence, it is necessary to expect a significant change in the current trend — either the weakening or reversal of this trend — that is the increase of the unpredictability of the price dynamics. Consequently it is recommended to complete all transactions concluded earlier in the direction of the current trend. Meanwhile the best time to close the position (in terms of profit maximization of the economic agent) should be considered the moment when the value of the VM indicator reaches a local maximum.

The reduction of the VM indicator suggests that market participants have unanimous views on the future dynamics of the market price and the current trend, at least, has begun to be formed.

Therefore, the VM indicator quantitatively measures the psychological mood of the market and, because of its economic sense, it can be used for forecast modeling of the trend dynamics and, as a result, to be regarded as quantitative measure of the risk of loss when trading in financial markets.

Since the prices involved in «building» a candle are the results of action-minded market participants, and the VM indicator, because of its economic sense, reflects the «market sentiment». The VM indicator can be considered as a measure of the market in terms of reflexivity by George Soros [12, pp. 50-52], who believes that it is almost impossible to have the equilibrium state of the financial market in real life. The supply and demand curves do not only correlate with each other but also with the market participants mindsets, which in their turn may significantly affect these curves. Purchase or sale decisions are made based on the forecasts of future prices, which, oddly enough, are largely determined by these decisions made in the real time. In the last decades the role of expectations has substantially increased because an economic agent can work in financial markets, using a large banking arm.

The assumption that the VM indicator can be considered as a measure of market reflexivity was proved in [13] using the entropy of Grassberger-Prokaccia (for details on the algorithm of this entropy calculation, see [14]).

Figure 2 presents graphs of the value indicator VM and the quantitative indicator of trend strength |DClose| for the time period from 06/02/2004 00:00 to 00:00 08/06/2004 for the currency pair EUR / USD FOREX with depth at the time horizon of $\Delta t = 1$.

At the current time t $|\Delta Close_t| = |Close_t - Close_{t-\Delta t}|$ ($|\Delta Close|$ in Fig. 2 is taken modulo a factor of 2500 and increased by 1.0 for better visibility).

Figure 2 shows that if the value of $|\Delta Close|$ increases, the VM indicator decreases, and vice versa; if the VM indicator increases, the value of $|\Delta Close|$ decreases.

The proposed indicator of the current volatility is significantly different from the above-mentioned types of volatility. Here are, from a methodological point of view, the most important of these differences:

• when calculating the current volatility, one does not use a lot of members of the time series of prices, as it happens when calculating other volatility indicators. When taking into account information about the price dynamics history, a problem of «aftereffect» arises (the event took place «a long time ago» but its influence on the market volatility can be seen «now»). This effect contributes additional disturbances,

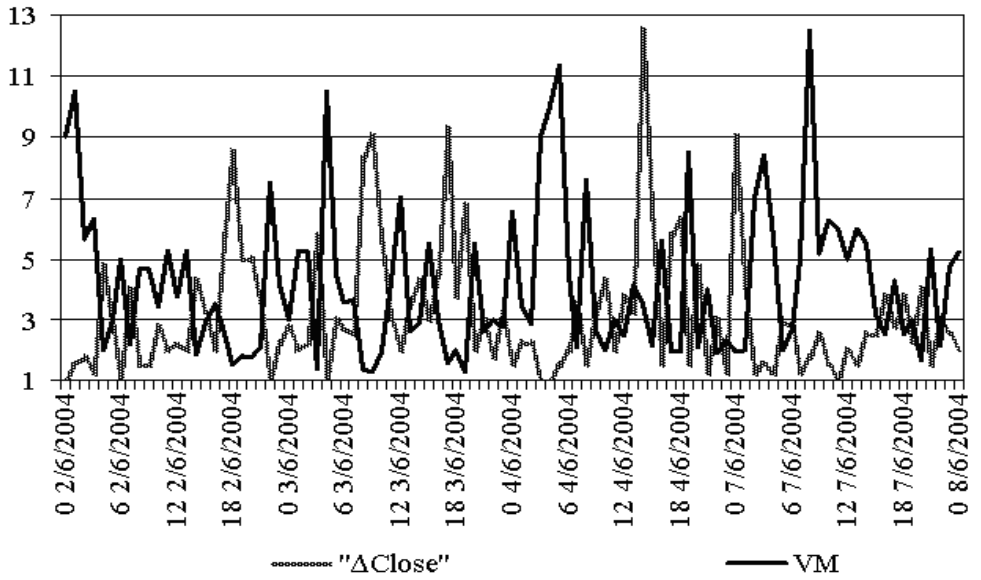

Fig. 2. Graphs of the VM factor and trend |ΔClose| changes (Calculated by the author)

which are not always adequate, into the whole forecasting process, thus, making the forecasting results incorrect. Besides, economic agents usually need important information that allows them to make current investment decisions in real time. The socio-economic sense of the VM indicator reflects the market participants needs better than the ideology of other volatility indicators described in [3-4];

• taking such an important characteristic as the market reflection into account significantly distinguishes the VM indicator from other volatility indicators and increases the relevance and information of the content analysis and forecasting processes in financial markets;

• the calculating method of the current volatility indicator, in contrast to the methods of calculating other volatility types, considers the most complete current information about the price dynamics. That is all kinds of prices that determine the current market trend: Open, High, Low, Close, which is also an advantage of the VM indicator when comparing to other volatility indicators.

The mentioned above differences greatly distinguish the VM indicator from the mentioned volatility types because they can be used in the current forecasting trend modeling in financial markets.

Further studies have shown that the indicator of the current market volatility can be effectively used for forecasting modeling of the price dynamics in financial markets.

In conclusion it must be said that the approaches to volatility calculation that had existed prior to the current volatility indicator had not worked well enough as forecasting market indicators.

The use of current volatility in forecast trend modeling in financial markets

The Practical application of the current market volatility indicator is implemented in the model, which represents an analogue of the mechanical trading system that is used by traders working in financial markets.

The general form of the model can be described by the formula:

$$MP(t) = F(\Delta t, P(t), n, m, k), \quad (7)$$

where MP is an operation which has 3 states: «buy», «sell», «do nothing»;

F is an operator with significant nonlinear characteristics, which transfers from the space of vector-valued function P(t) into the space of decision «buy», «sell», «do nothing» and is described verbally in the work;

Δt is the depth of the temporary horizon, in which either the model or periodicity of the quotation arrivals works;

P(t) is a vector-function whose components are the numerical values of the price series Open(t), High(t), Low(t), Close(t);

n, m, k are controlling parameters of the model, which are described below.

The VM indicator determines the strength inherent in the formula for calculating the socio-economic sense as well as the right moment for making a deal, but not the type of the transaction (purchase or sale). As an indicator, which shows the direction of the future trend, the value of the current value sign ΔAP_t

($\Delta AP_t = AP_t - AP_{t-\Delta t}$, $AP_t = \frac{Open(t) + High(t) + Low(t) + Close(t)}{4}$) at the certain time period t is used.

If the current value ΔAP_t becomes greater than zero, one should expect a trend increase and as a result a purchase operation. When the current value ΔAP_t is less than zero, one should expect a trend degrease and a sale operation. ΔAP_t has been chosen not to allocate the advantage of a certain quotation over the rest of the quotes that take place in forming the candle. We think that any quote that comes to the capital market is the result of the existing trend analysis made by the market participants. It is therefore proposed to use integral indicator of the candle — ΔAP_t, which is also, in our opinion, closer to the real meaning of the possible transaction prices for a certain period of time Δt that has also been proved by the further studies.

As an indicator of the end of the transaction we propose to change the current sign of ΔAP_t to the opposite one.

Thus, the analytical form of this model can be described as:

$$MP(t) = \begin{cases} \begin{cases} \frac{\frac{1}{m}\sum_{i=1}^{m} VM_{t-i\bullet\Delta t}}{VM_t} > n \\ \Delta AP_t > k \end{cases} & ;\text{start of buying} \\ \begin{cases} \frac{\frac{1}{m}\sum_{i=1}^{m} VM_{t-i\bullet\Delta t}}{VM_t} > n \\ \Delta AP_t < k \end{cases} & ;\text{start of sale} \\ \Delta AP_t \text{ changes its sign - the end of the current transaction} \end{cases} \quad (8)$$

We want to introduce some assumptions to simplify the model:

1. In order to test the presented model we have chosen FOREX market. Let us assume that the size of the trade deposit is $ 1,000 and the amount of leverage that a broker gives to a market participant is 100. Thus, the size of the lot will be $ 100,000.

2. The transaction costs will be the ones that are used in the FOREX dealing centers of Ukrsotsbank (3 points or $ 30 per transaction). At the same time the revenue from the transaction will be calculated taking into account the transaction costs.

3. The slippage (a change in the market prices for the period of the investment decision prior to its implementation in the real deal) will be 5 points or $ 50 per operation or $ 100 per transaction.

4. The signal for a market participant to prepare for a transaction at time t will be assumed the decrease of the current indicator of VM_t from the previous one in n times. Such value change of the indicator VM_t suggests that the current market volatility has substantially declined, which indicates an increase in market participants consensus on the nature of the trend in the near future and reduction of the risk level when undertaking the exchange operation. That is the way the current volatility is used in the model as a quantitative measure of reflexivity of the market.

5. The following conditions will be considered to be the criteria for determining the start of the transaction:

- $\Delta AP_t > k$ is a signal to buy;
- $\Delta AP_t > k$ is a signal to sale,
- k is a parameter, which is the measure of the trend strength for the current period of time Δt, or the tangent of the angulations of the linearized trend for the time period Δt.
- $\frac{\frac{1}{m}\sum_{i=1}^{m} VM_{t-i\Delta t}}{VM_t} > n$, (9)
- n and m are the given model parameters for its better adaptation to the market, the behavior of price dynamics that is strongly nonlinear and depends on many factors, which are not taken into account in the model;

• n is a threshold value of relative change VM or an indicator of how many times the current value has decreased the risk of loss in carrying out trade transactions in the market (see equation (3));

• m is the number of candles involved in the calculation that is a quantitative indicator of the level of determinism in the current trend or the depth of the «market memory», which is taken into account in the calculations.

6. Signal, confirming the previous one (for example, a row of signals for a purchase following each other in succession) is ignored.

7. The signal for closing the current transaction will be the change of the sign ΔAP_t into an opposite one.

8. We shall calculate the financial results of transactions using the model at average prices of AP: the financial result of the sale transaction is the difference between the price AP of the beginning transaction and the price AP of the end transaction (for the purchase transactions one will use a minus sign before the transaction result).

9. The criteria of results effectiveness of the model application will be the income for the analyzed period.

10. We shall neglect the interruptions in the work of the market (such as holidays and weekends).

11. The quotation supplied to the market participants takes into account all factors affecting the price dynamics in financial markets.

The proposed model was tested during the study of the dynamics of the currency pair quotes the EUR / USD FOREX for 7 months (from 01.08.2008 to 02.03.2009 during the financial crisis) at the depth of the working horizon in a day (182 quotes). For comparison, the model was tested for the same pair of currencies in the period before the financial crisis for 7 months (01.01.2007 to 31.07.2007) at the same depth of the working horizon (182 quotations). Source of quote: [15].

The main results of the model testing are shown in Figure 2.

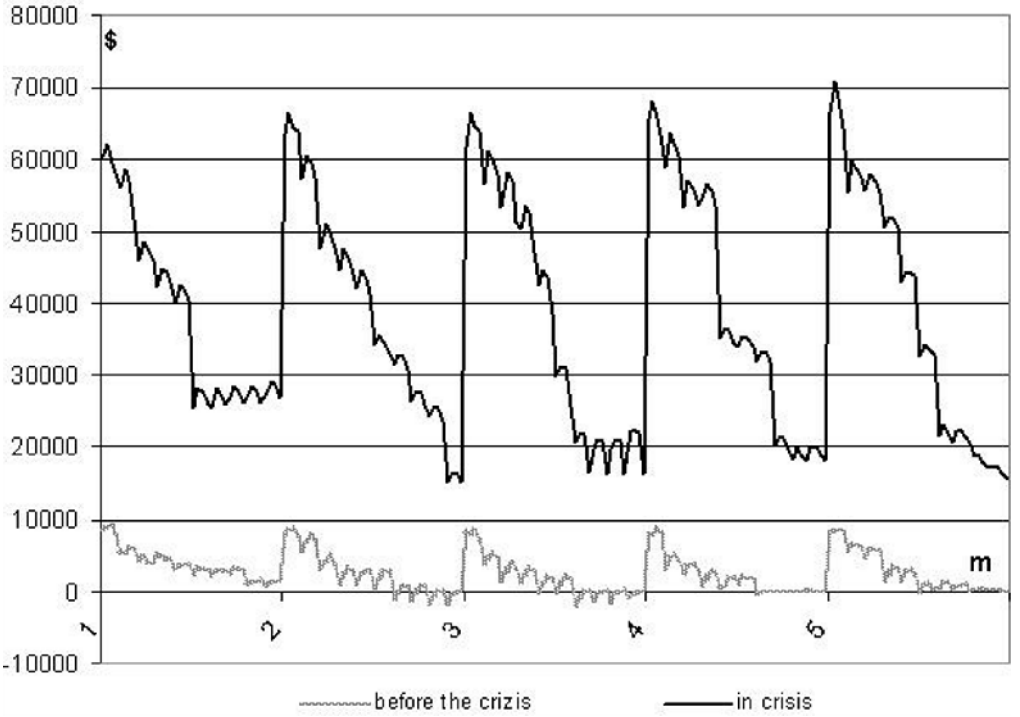

Fig. 3. The graph of the profit ($) when using the model depending on the parameter m (Calculated by the author)

CONCLUSIONS

When analyzing the results of the model testing, we can draw the following conclusions:

1. Even if the essential value of the slippage (10 points against 4, which is usually used in practice) is high, the size of the profit during the financial crisis is about $7000 – $9000 a month or 700-900% profitability depending on the control parameters of the model.

2. Such high profitability of operations is due to the significant market volatility (during the crisis the average volatility VM for the analyzed period was 16.88, while before the crisis for the same period VM had been 9.84). Before the crisis the volatility level was lowered and that was the reason for the average profitability of operations to decrease to 45-70% per month depending on the control parameters of the model.

3. The high return from operations, even if the slippage is very rigid, confirms the adequacy of the model. Moreover, the higher the volatility of the analyzed market is, the higher is profitability of the model.

4. In accordance with the data shown in Fig. 2, we can conclude that during the crisis one should use the model taking into account the long «memory of the market» for the small value of the parameter n (n = 2, which is not a rigid requirement imposed on the variation of the VM indicator at the beginning of the transaction: the formula (9)): The figure shows that the maximum return is obtained while using the «memory of the market» during 5 days (or m = 5).

5. The effectiveness of the model application depends on the parameter k, which determines the strength of an emerging trend. During the crisis, however, the value of the parameter k must be more than 0,002, whereas prior to the crisis the optimal value of the parameter k was less than 0,002. By setting such high demands on the strength of the nascent trend one can significantly increase the profitability of trading operations.

6. Considering the graphs in Fig. 3, it appears that with increase of the formula stringency (5) — the parameter n — the return from operations decreases. Fig. 3 shows this reduction as dips in the graph. Moreover, if the value of the parameter n one should not consider a long «memory of the market» (one can limit m = 1).

The above model (in its various versions) has been successfully tested enough to predict trends in:

- FOREX (various currency pairs for different depths of time horizons);
- NYSE (stock, Boeing and Coca-cola for different depths of time horizons);
- RTS (options to the depths of time horizon of 1 day),
- as well as analyze and predict indexes of NASDAQ, S&P and RTS (to the depths of the time horizon of 1 day).

At the same time the return on investment, according to the model, when taking the above assumptions into consideration, was measured in tens of percent per month.

Such effectiveness of the model shows that the proposed rate of the current volatility VM, which takes into account the market reflection, is an effective tool for predictive modeling of current trends in financial markets.

Some authors [16-17] have defined the area of the effective use of the analyzed model, taking into account the current market volatility, which shows that the most efficient way to use this model is for prediction of trends in financial markets when the depths of time horizon (the frequency of incoming quotes to market participants) is from 10 – 20 minutes to 1 day. This confirms the adequacy of the name of the model (the current volatility) and the socio-economic content of the VM indicator.

The VM indicator was also quite successfully used for modeling the use of balances on current customer accounts as a bank resource base without creating a situation where the bank is unable to pay off customers at their request, especially when this is the cheapest financial resource for commercial banks (although this is the most unstable part of the bank resources) [18].

All of the above suggests the following:

- one should take into account the reflexivity of the market, as its essential attribute, and is necessary and methodologically adequate for predictive modeling of trends in financial markets;
- volatility is a universal and important feature of such socio-economic systems as financial markets. The current volatility VM, because of its socio-economic sense, can be effectively used to forecast trends in modeling as it is a quantitative measure of reflexivity of such systems.

In general, however, it would be perfectly correct to say that the approach to modeling the price index dynamics using the current volatility as a measure of reflexivity of the market has a great scientific, methodological and practical value.

REFERENCES

1. Kussy M. Predictive modeling of the trends dynamics in the FOREX taking into account the fractality and the reflexivity of the market / M. Kussy // Culture of the Black Sea peoples. — 2004. — №48. — Vol. 1. — PP. 35-39

in Russian: Куссый М.Ю. Прогнозное моделирование динамики трендов на FOREX с учетом фрактальности и рефлексивности рынка / М.Ю. Куссый // Культура народов Причерноморья. — 2004. — № 48. — Т. 1. — С. 35-39.

2. Yakimkin V.N. Financial dealing. Book 1 / V.N. Yakimkin. — Moscow: IKF Omega-L, 2001. — 469 p.
in Russian: Якимкин В.Н. Финансовый дилинг. Книга 1 / В.Н. Якимкин. — М.: ИКФ Омега-Л, 2001. — 469 с.

3. Chekulayev M. Risk management: financial risk management based on the volatility's analysis / M. Chekulayev. — Moscow: Alpine Publisher, 2002. — 344 p.
in Russian: Чекулаев М. Риск-менеджмент: управления финансовыми рисками на основе анализа волатильности / М. Чекулаев. — М.: Альпина Паблишер, 2002. — 344 с.

4. Peters E. Fractal market analysis: applying chaos theory to investments and economics / E. Peters. — Moscow: Internet-trading, 2004. — 304 p.
in Russian: Петерс Э. Фрактальный анализ финансовых рынков: применение теории Хаоса в инвестициях и экономике / Э. Петерс. — М.: Интернет-трейдинг, 2004. — 304 с.

5. Peters E. Chaos and order in the capital markets / E. Peters. — Moscow: Mir, 2000. — 333 p.
in Russian: Петерс Э. Хаос и порядок на рынках капитала. Аналитический взгляд на циклы, цены и изменчивость рынка / Э. Петерс. — М.: Мир, 2000. — 333 с.

6. Alexander S. Price movements in speculative markets: trends or random walks / S. Alexander // International Management Review. — 1961. — Vol. 2. — PP. 7-26.

7. Cheng B. On Consistent Non-parametric Order Determination and Chaos / B. Cheng and H. Tong // Journal of the Royal Statistical Society. Series B. — 1992. — Vol. 54. — PP. 427–449.

8. Cheung Y.-W. Long Memory in Foreign Exchange Rates / Y.-W. Cheung // Journal of Business and Economic Statistics. — 1993. — Vol. 11. — PP. 93–101.

9. De Bondt W. Does the Stock Market Overreact? / W. De Bondt, R. Thaler // Journal of Finance. — 1985. — Vol. 40. — PP. 793-808.

10. Hsieh O.A. Chaos and Nonlinear Dynamics: Application to Financial Markets / O.A. Hsieh // Journal of Finance. — 1991. — Vol. 46. — PP. 1839-1877.

11. Radzicki M. Institutional Dynamics, Deterministic Chaos, and Self- Organizing Systems / M. Radzicki // Journal of Economic Issues. — 1990. — Vol. 24. — PP. 57-102.

12. Soros G. The Alchemy of Finance / G. Soros. — Moscow: Infra-M, 1996. — 415 p.
in Russian: Сорос Дж. Алхимия финансов / Дж. Сорос. — М.: Инфра-М, 1996. — 415 с.

13. Ermolenko G. The detection of volatility depending on the entropy in the FOREX / G. Ermolenko, M. Kussy, R. Morozov, S. Scherbina // Culture of the Black Sea peoples. — 2006. — №74. — Vol. 2. — PP. 16-19.
in Russian: Ермоленко Г.Г. Выявление зависимости волатильности от энтропии на FOREX / Г.Г. Ермоленко, М.Ю. Куссый, Р.А. Морозов, С.В. Щербина // Культура народов Причерноморья. — 2006. — № 74. — Т.2. — С. 16-19.

14. Pincus S.M. Approximate entropy as a measure of system complexity / S.M. Pincus // Proc. Natl. Acad. Sci. USA, Mathematics. — 1991. — March. — Vol. 88. — PP. 2297-2301.

15. http://forexite.com/default.html?34.

16. Kussy M. Determination of the effective use of predictive models of the prices's dynamics in FOREX, taking into account the current market volatility / M. Kussy, G. Morozova // Culture of the Black Sea peoples. — 2008. — №124. — PP. 33-36.
in Russian: Куссый М.Ю. Определение области эффективного применения прогнозной модели динамики цены на FOREX с учетом текущей волатильности рынка / М.Ю. Куссый, Г.С. Морозова // Культура народов Причерноморья. — 2008. — №124. — С. 33-36.

17. Kussy M. Determination of the effective use of predictive models of the prices's dynamics in the stock market taking into account the current market volatility / M. Kussy, A. Doroshenko, P. Sivura // Culture of the Black Sea peoples. — 2008. — № 140. — PP. 92-96.
in Russian: Куссый М.Ю. Определение области эффективного применения прогнозных моделей динамики цены на фондовом рынке с учетом текущей волатильности рынка / М.Ю. Куссый, А.Н. Дорошенко, П.А. Сивура // Культура народов Причерноморья. — 2008. — № 140. — С. 92-96.

18. Kussy M. Model of the current balances in client accounts as a resource base of the bank / M. Kussy, P. Kussy, R. Morozov, G. Morozova // Culture of the Black Sea peoples. — 2007. — №108. — PP. 40-42.
in Russian: Куссый М.Ю. Модель использования остатков средств на текущих клиентских счетах в качестве ресурсной базы банка / М.Ю. Куссый, П.М. Куссый, Р.А. Морозов, Г.С. Морозова // Культура народов Причерноморья. — 2007. — №108. — С. 40-42.

Стаття надійшла до редакції 28 грудня 2012 року