Abstracts of MMA2016, June 1–4, 2016, Tartu, Estonia

MATHEMATICAL MODELING OF FINANCIAL TIME SERIES: PROBLEM OF FORECASTING

SERGEJS HILKEVICS and GALINA HILKEVICA

Ventspils University College

Inzenieru iela 101, LV-3601, Ventspils, Latvia

E-mail: sergejs.hilkevics@venta.lv, galina.hilkevica@venta.lv

Financial time series modeling is a wide branch of financial mathematics, which became as a subject of significant and growing interest during last years. There are two main reasons of this interest growth - the first one is traditional and is based on investment theory need for assets allocation optimization, the second one is untraditional and is based on so called "econophysics", or attempts to implement methods of statistical physics mostly for new economic crisis forecasting.

This report is devoted to the description of new approach to financial time series mathematical modeling. At first we generate financial time series $P(t)$ as superpositions of regular $R(t)$, chaotic $H(t)$ and stochastic $S(t)$ time series

$$P(t) = \alpha R(t) + \beta H(T) + \gamma S(t), \alpha + \beta + \gamma = 1. \quad (1)$$

At second, we study the possibility to forecast the behavior of generated time series. From forecasting point of view regular component $R(t)$ is predictable best of all, stochastic component $S(t)$ is completely, chaotic component $H(t)$ predictability lies between $R(t)$ and $S(t)$ - until certain time horizon $H(t)$ is predictable, but after that bifurcation makes forecasting is impossible. The possibility to forecast the behavior of superposition $P(t)$ depends on the proportion of weight factors α, β and γ in total sum.

At third, we compare the behavior of generated artificial time series with the behavior of real USA stocks and show, that there are similarities between USA stocks time series and superposition of Gauss time series with linear trends.

The development of methods of mathematical modelling of financial time series is very important for practical applications in portfolio theory.