EUROPEAN-TYPE OPTIONS IN THE DIFFUSION MODEL (B,S)-FINANCIAL MARKET ON THE BASIS OF EXTREME VALUE OF BASIC ASSET PRICE

Andreeva U.V., Anikina A.V. [1], Dyomin N.S., Rozhkova S.V.[1]

Tomsk State University, Department of Applied Mathematics and Cybernetics,
36 Lenin ave. 634050 Tomsk, Russia,
Tel: (3822)-529-599, e-mail: svrhm@rambler.ru
[1]Tomsk Polytechnic University, Department of Natural Sciences and Mathematics
30 Lenin ave. 634050 Tomsk, Russia,
Tel: (3822)-563-350, e-mail: rozhkova@tpu.ru

The investor builds up the investment portfolio with capital $X_t = \beta_t B_t + \gamma_t S_t$, $t \in [0,T]$, where B_t is the price of riskfree asset, S_t is the basic (risk) asset price , β_t and γ_t are shares (quantities) of corresponding assets in the capital, $B_t = B_0 \exp\{rt\}$, $S_t = S_0 \exp\{(\mu - (\sigma^2/2))t + \sigma W_t\}$, where $B_0 > 0$, $S_0 > 0$, $r > 0$, $\sigma > 0$, i.e. a diffusion model of (B,S) - financial market [1] is under consideration. In the case of standard call and put options payment obligations (functions) are given by [1]

$$f_T^c(S_T) = \max\{(S_t - K),0\}, \quad f_T^p(S_T) = \max\{(K - S_t), 0\}, \tag{1}$$

where K is the striking price of option. The subject of this work is research of call and put options, which belong to exotic options class [2] and are based on the extreme value of basic asset price, the payoff functions of which are given by

$$f_T^{c\max} = \max\left\{\left(\max_{0\le t\le T} S_t - K\right), 0\right\}, \quad f_T^{c\min} = \max\left\{\left(\min_{0\le t\le T} S_t - K\right), 0\right\}, \tag{2}$$

$$f_T^{p\min} = \max\left\{\left(K - \min_{0\le t\le T} S_t\right), 0\right\}, \quad f_T^{p\max} = \max\left\{\left(K - \max_{0\le t\le T} S_t\right), 0\right\}. \tag{3}$$

In this work there has been found formulas which determine the value of options, corresponding to payment obligations (2), (3), as well as formulas which determine time evolution of portfolios $\pi_t^* = (\beta_t^*, \gamma_t^*)$ and capitals X_t^*, which ensure the fulfillment of the payment obligation.

References

1. *Shiryaev A.N.* Foundations of stochastic financial mathematics. M.: FAZIS, 1998. 1016 P. (in Russian)
2. *Kozhin K.* All about exotic options // Securities market. 2002. N. 15-17. (in Russian)