THE CONSTRUCTION OF RISKLESS PORTFOLIO FOR STUDENT-LIKE FAT MODELS

[1]Musienko J, [2] Shchestyuk N..
[1] National University "KyIv-Mohila Academy", Ukraine
mursienko@ukr.net
[2] National University "KyIv-Mohila Academy", Ukraine
Natalyshch@gmail.com

Black, Scholes and Merton [1] showed using lemma Ito that it is possible to set up a riskless portfolio consisting of a position in an option on a stock and a position in the stock. Expressed in terms of Δ - "delta", the Black-Scholes portfolio is

-1:   derivative (option),

$+\Delta$:   shares of th stock.

The holder of this portfolio is short one derivative and long an amount Δ of shares. Using delta terminology [3], we can say that Black and Scholes valued options be setting up delta-neutral position and arguing that the return in the position should be the risk-free interest rate.

In this paper we set up a riskless portfolio for alternative to Black-Scholes GBM model that incorporates the Student-like distribution of the returns. This FAT model [2] gives asset prices as GBM but is driven by some nondecreasing stochastic "activity time" (or "fractal time") process. We consider the model for the stock price P_t, where parameters $\mu \in R$ and $\sigma > 0$ reflect drift and diffusion, and P_t is the strong solution of the SDE

$$dP_t = \mu P_t dt + \left(\theta + \frac{\sigma^2}{2} \right) P_t dT_t + \sigma P_t dW_{T_t}$$

We construct the activity time $T_t^{\,m} = \sum_{i=1}^{t} \tau_i^{\,m}$, where τ_i has reciprocal (inverse) Gamma distribution $R\Gamma(\alpha, \beta)$.

References

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