VARIANCE-GGC MODEL AND ITS SENSITIVITY ANALYSIS

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In this paper, we propose an extension of the variance-gamma model using a subclass of infinite divisible random variables–generalized Gamma convolutions (GGC). The new model is named as variance-GGC model. By this extension, the variance-GGC model is much richer than the variance-gamma model, but it can also keep some nice properties of the variance-Gamma model.The skewness and kurtosis of variance-GGC processes are calculated out and the relation of the skewness and kurtosis between GGC process and corresponding variance-GGC process are obtained. At last, sensitivity analysis of this model has been conducted. First, we define a stochastic process by S_T

$$S_T = S_0 \exp\left(\theta \int_0^\infty g(s)d\gamma_s + \tau\sqrt{T}\Theta + Z_T + c(\theta,\tau)T \right), \qquad \theta \in \mathbb{R} \text{ and } \tau \in \mathbb{R}_+,$$

where $\int_0^\infty g(s)d\gamma_s$ is a GGC random variable and Θ is a Gaussian random variable. By setting Z_T as another GGC, the exponent of S_T is a variance-GGC process. Then the Greek formula of variance-GGC with respect to the initial value S_0 is as follow

$$\frac{\partial}{\partial S_0} E_P[\Phi(S_T)] = \frac{1}{S_0} E_P[\Phi(S_T)L_T],$$

where

$$L_T = \frac{\theta \int_0^\infty 2g(s)f(s)^2 d\gamma_s}{(\theta \int_0^\infty g(s)f(s)d\gamma_s + \tau\sqrt{T}\eta)^2} + \frac{\int_0^\infty f(s)d\gamma_s - T\int_0^\infty f(s)ds + <\eta,\Theta>}{\theta \int_0^\infty g(s)f(s)d\gamma_s + \tau\sqrt{T}\eta}.$$

and $f : \mathbb{R}_+ \to (0,a)$ is a positive function. Besides, the Greeks for two parameters θ and τ and the second derivative of S_0 in our model are also calculated out.

References

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