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Pricing barrier options in the Variance-Gamma model

One of the main criteria for evaluating a pricing model is its ability to produce analytical formulas for the prices of benchmark options. Variance-Gamma model has already proved to be a reasonable generalization of the Black–Scholes model: it can provide a better fit to the market data and at the same time the prices of European options can be computed in (almost) closed form. Unfortunately the picture is completely different for the barrier options: the payoffs of these weakly path-dependent derivatives depend on the first passage time of the stock, and this random variable is very hard to control in the case of infinite-activity Levy jump processes. In this talk we will present a new, semi-analytical method for computing distribution of the first passage time. In our approach we use the construction of the VG process as a time changed Brownian motion to extract additional information about the first passage time. We will present numerical results and a comparison of our method to PIDE and Wiener–Hopf methods.