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A finite difference scheme for option pricing in jump diffusion and exponential Lévy models.
(English) [Zbl 1101.47059](#)
SIAM J. Numer. Anal. 43, No. 4, 1596-1626 (2005).

The authors propose a finite difference approach to finding the solution of a parabolic partial integro-differential equation (PIDE) with possible singular kernels. This problem is discussed within the framework of the option pricing of an underlying random asset that is driven by a Lévy process or a more general time-inhomogeneous jump-diffusion model. Solving the aforementioned PIDE by finite difference methods involves several approximations such as the localization of the PIDE to a bounded domain, treatment of the singularity arising from small jumps, discretization of the equation in space and iteration in time.

The paper provides a discussion of localization errors and an estimate for such errors under an integrability condition on the Lévy measure. In this context, the authors propose an explicit-implicit finite difference scheme for which issues related to the pricing of European and barrier options, consistency, stability and convergence are discussed. By way of conclusion, numerical tests are done for smooth and nonsmooth initial conditions in order to determine the effect of various numerical parameters on the accuracy of the finite difference method.

Reviewer: Mark A. Petersen (Potchefstroom)

MSC:

- [47N10](#) Applications of operator theory in optimization, convex analysis, mathematical programming, economics
- [47G20](#) Integro-differential operators
- [65M06](#) Finite difference methods for initial value and initial-boundary value problems involving PDEs
- [65M12](#) Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs
- [49L25](#) Viscosity solutions to Hamilton-Jacobi equations in optimal control and differential games
- [60H30](#) Applications of stochastic analysis (to PDEs, etc.)
- [60G51](#) Processes with independent increments; Lévy processes
- [91G60](#) Numerical methods (including Monte Carlo methods)

Cited in **146** Documents

Keywords:

parabolic integro-differential equations; finite difference methods; Lévy process; jump-diffusion models; option pricing; viscosity solutions

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