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"Convergence of Numerical Approximation for Jump Models Involving Delay and Mean-Reverting Square Root Process "

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Review

Motivated by the fact that financial modeling with stochastic differential equations (SDEs) driven by white noise cannot capture certain observed phenomena, adding jump terms according to a Poisson process has been suggested. In this paper the authors consider a volatility which is past-level-dependent as made concrete by the scalar model problem

$$dS(t) = \alpha[\mu - S(t)] + \sigma S(t-\tau)^{\gamma} \sqrt{S(t)} dW(t) + \delta S(t) d\widetilde{N}(t),$$

that is, a delay SDE with jump terms (this is Eq. (2) in the paper). Parameters of the model are $\{\alpha, \mu, \sigma, \delta\}$, $W(t)$ is Brownian motion, and $\widetilde{N}(t)$ a compensated Poisson process with constant intensity. Due to the nonlinear character of the diffusion coefficient, classical existence and uniqueness results do not carry through. Furthermore, since analytical solutions are not known, numerical simulations are important, e.g. when evaluating financial strategies.

With proper (positive) initial data the authors show well-posedness and positivity of the solutions and also demonstrate that the model is mean reverting. Numerical solutions are subsequently considered and the main result of the paper is the strong convergence of the Euler-Maruyama method with a rather technical proof. For this reason the paper is probably of interest for researchers looking at delay SDEs.

MSC 2010 classification: 60H10 (primary); 65L20 (secondary).