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Weak Subordination of Multivariate Lévy Processes

Abstract:

Subordination is the operation which evaluates a Lévy process at a subordinator, giving rise to a pathwise construction of a "time-changed" process. Originating with Bochner in the context of probability semigroups, subordination was applied by Madan and Seneta to create the variance-gamma process, which is prominently used in financial modelling. However, unless the subordinate has independent components or the subordinator has indistinguishable components, subordination may not produce a Lévy process. We introduce a new operation known as weak subordination that always produces a Lévy process by assigning the distribution of the subordinate conditional on the value of the subordinator, and matches traditional subordination in law in the cases above. Weak subordination is applied to extend the class of variance generalised gamma convolutions and to construct the weak variance-alpha-gamma process. The latter process exhibits a wider range of dependence than using traditional subordination, and we study methods for estimating its parameters.

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