

Valuation of exotic and credit derivatives in Lévy models

ERNST EBERLEIN AND ANTONIS PAPAPANTOLEON

*Department of Mathematical Stochastics, University of Freiburg, Eckerstr. 1,
79104 Freiburg, Germany*
{eberlein,papapan}@stochastik.uni-freiburg.de

ABSTRACT

The aim of this work is to combine Fourier transform methods for option valuation with the celebrated Wiener–Hopf factorization of Lévy processes, in order to provide semi-explicit formulae for the valuation of exotic path-dependent and credit derivatives on assets driven by Lévy processes.

The Wiener–Hopf factorization provides the link between the characteristic functions of the supremum, infimum and the Lévy process itself; for a detailed account, one can refer to the recent book [2].

The first step is to derive formulae for the valuation of options that depend on a functional of the underlying process; examples of such functionals are the price process itself or the supremum of the price process. Therefore, we can value standard European options and also fixed strike lookback options (and, using duality methods, floating strike lookback options as well, cf. [1]).

Then, a by-product of this result is a formula for the first passage time of a Lévy process above or below a fixed barrier. This result will allow us to value an equity default swap, a product which is gaining increasing popularity in the derivatives market lately. In addition, we can treat credit derivatives in a structural framework (see e.g. [3]).

References

- [1] Eberlein, E., A. Papapantoleon and A. N. Shiryaev, On the duality principle in option pricing: semimartingale setting, FDM Preprint 92, 2006.
- [2] Kyprianou, A. E., *Introductory Lectures on Fluctuations of Lévy Processes with Applications*, Springer, 2006.
- [3] Merton, R., On the pricing of corporate debt: the risk structure of interest rates, *J. Finance* 29, 449-470, 1974.