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DEPARTMENT OF STATISTICS AND ACTUARIAL SCIENCE
THE UNIVERSITY OF HONG KONG

Seminar

Dr. Daniel LINDERS

Actuarial Research Group
KU Leuven
Belgium

will give a talk

entitled

BASKET OPTION PRICING AND IMPLIED CORRELATION IN A LÉVY COPULA MODEL

Abstract

We start from the one-factor Lévy model introduced in [1] to build a multivariate stock price model with correlated Lévy marginals. We show that our model generalizes the Gaussian model (with single correlation) and distributions like the Variance Gamma, Normal Inverse Gaussian and Meixner are now allowed for modeling the individual stock price dynamics. As a result, this new Lévy copula model significantly increases the ability of finding a suitable distribution for the individual stocks, whereas the dependence is still captured by a correlation matrix.

In a first part, we consider the problem of finding accurate approximations for the price of a basket option in the Lévy copula model. In order to value a basket option, the distribution of this basket has to be determined. However, the basket is a weighted sum of dependent stock prices and its distribution function is unknown or too complex to work with. Therefore, we replace the random variable describing the basket price at maturity by a random variable with a more simple structure. Moreover, the characteristic exponent of this approximate random variable is given in closed form, such that the Carr-Madan formula can be used to determine approximate basket option prices. Numerical examples illustrate the accuracy of our approximations.

In a second part of the talk we show how the well-established notions of implied volatility and implied correlation can be defined in our Lévy copula model. One main advantage of our Lévy copula model is that each stock is described by a volatility parameter and the marginal parameters can be calibrated separately from the correlation parameter. However, the available market prices for basket options together with our newly designed basket option pricing formula enables us to determine implied Lévy correlation estimates. We observe that implied correlation depends on the strike and the so-called implied Lévy correlation smile is flatter than its Gaussian counterpart. The standard technique to price non-traded basket options (or other multi-asset derivatives), is by interpolating on the implied correlation curve. It is shown in [2] that in the Gaussian copula model, this can sometimes lead to non-meaningful correlation values. We show that the Lévy version of the implied correlation solves (at least to some extent) this problem.

Keywords basket options, characteristic function, implied correlation, Lévy market, model risk.

on

Friday, August 8, 2014

11:00 a.m. – 12:00 noon

at

T5, 1/F, Meng Wah Complex

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All interested are welcome