Multivariate diffusion modelling

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Tractable classes of multivariate diffusions are presented. For any given symmetric multivariate distribution, a diffusion process with linear drift and with marginal distribution equal to the given distribution is constructed. In particular, an expression for the diffusion matrix is given. In many examples this expression is explicit, and an approximation of the saddle-point type is given for use when it is not. The theory is particularly simple for normal variance-mixtures such as the symmetric generalized hyperbolic distributions; for an introduction to this class of distributions, see e.g. [2]. As a particular case, multivariate t-diffusions are considered.

Superposition of such multivariate diffusions result in a very flexible and tractable class of multivariate processes that generalize the one-dimensional models presented in [1]. Again any symmetric distribution can be obtained as the marginal distribution.

As a byproduct, one-dimensional processes can be obtained with a more general autocorrelation structure than the processes in [1]. In particular, a negative autocorrelation is possible. One application to finance of the theory presented here is to model the volatility process by means of a one-dimensional process of this type, and thus obtain a very flexible class of stochastic volatility models.

This is joint work with Martin Jacobsen, University of Copenhagen.

1. Bibby, B.M., Skovgaard, I.M., and Sørensen, M. (2003). Diffusion-type models with given marginals and autocorrelation function. Department of Applied Mathematics and Statistics, University of Copenhagen, Preprint No. 2003-5. To appear in *Bernoulli*.
2. Bibby, B.M. and Sørensen, M. (2003). Hyperbolic processes in finance. In: S. Rachev (Ed.): *Handbook of Heavy Tailed Distributions in Finance*. Elsevier Science, Amsterdam, 211–248.