

A course on
Estimation of fat-tailed and skewed asset return distributions

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Outline

Empirical evidence has demonstrated that the probability law of asset returns shows fat tails and asymmetries, making the assumption of normality unrealistic and inadequate.

Among all the parametric probability laws that may capture these features, the most appropriate one is the α -stable distribution. The importance of this distribution stems from empirical and theoretical properties. This distribution may reproduce the fat tails and the asymmetry observed in the data. Moreover, it is stable, in the sense that sums of α -stable random variables are also α -stable. This is an attractive property for the construction of portfolios.

The main difficulty of alpha-stable distributions is their estimation. The density function does not have a closed form, which renders maximum likelihood a challenging task (though feasible). Estimation methods based on the characteristic function have been proposed for the univariate case. But they are unfeasible for large dimensions. Simulation-based methods, such as Indirect Inference and the Method of Simulated Quantiles, appear to be appropriate methods as they are flexible enough to handle multivariate estimation.

Contents

1. The distribution of asset returns: evidence of fat tails and asymmetry?
2. A refreshment of statistical concepts
3. Indirect inference and the efficient method of moments
4. α -stable processes: definitions and properties
5. Univariate estimation: the Hill estimator, maximum likelihood, characteristic function methods and indirect inference
6. Multivariate stable processes: indirect inference and the method of simulated quantiles

Practice

All lectures are accompanied with computer practice in Matlab with real stock returns.

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