

Mini-course: Dependence, Risk bounds, Optimal Allocations and Portfolios

Ludger Rüschendorf (University of Freiburg, Germany)

The main focus in this course is on the description of the influence of dependence in multivariate stochastic models for risk vectors. In particular we are interested in the description of the impact of dependence on the formulation of risk bounds, on the range of portfolio risk measures on problems of optimal risk allocation (diversification), and the construction of optimal portfolios.

In more detail:

- 1) We will point out general methodological tools for dependence modeling and analysis. In particular we discuss Hoeffding–Fréchet bounds and mass transportation and their impact on the representation of risk measures for portfolio vectors, on the characterization of worst case dependence structures, and, in particular, on possible generalizations of comonotonic dependence structures.
- 2) We introduce to recent developments on obtaining (sharp) risk bounds for the Value at Risk and other risk functional of joint portfolios. A field of active recent development is the inclusion of partial dependence information to obtain improved risk bounds. In particular we also consider the question of model risk as, for example, apparent in several of the popular and much used credit risk models.
- 3) We give an introduction to the use of positive resp. negative dependence in order to construct improved (optimal) risk allocations and optimal portfolios. Applications to real data show the considerable potential of these relatively recent construction methods. Based on extreme value theory the notion of extreme risk index (ERI) is introduced and based on it a new method of portfolio optimization is introduced taking into account the inherent dependence between the data. This ERI based approach is compared with the Markowitz approach in an empirical study of S & P 500 data.

References:

Rüschendorf, L.: *Mathematical Risk Analysis*. Springer (2013), <http://www.springer.com/mathematics/probability/book/978-3-642-33589-1>