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Abstracts

Invited Plenary Talk (Mini Course: 120 Minutes)
Monday (Sept. 8, 2014), 15:30 - 16:30, and Tuesday (Sept. 9, 2014), 16:40 - 17:40

BERNARD Carole

Professor at the Department of Statistics and Actuarial Science, University of Waterloo, Canada

A new approach to assessing model risk on dependence in high dimensions

A central problem for regulators and risk managers concerns the risk assessment of an aggregate portfolio defined as the sum of d individual dependent risks X_i. This problem is mainly a numerical issue once the joint distribution of $(X_1,X_2,...,X_d)$ is fully specified. Unfortunately, while the marginal distributions of the risks X_i are often known, their interaction (dependence) is usually either unknown or only partially known, implying that any computed risk measure of the portfolio is subject to model uncertainty.

Previous academic research has focused on the maximum and minimum possible values of a given risk measure of the portfolio, in the case in which only the marginal distributions are known. This approach leads to wide bounds, as all information on the dependence is ignored.

We show how to integrate in a natural way available information on the multivariate dependence and provide easy-to-compute bounds for the risk measure at hand. We observe that incorporating the information of a well-fitted multivariate model may, or may not, lead to much tighter bounds, a feature that also depends on the risk measure used. We illustrate this point by showing that the Value-at-Risk at a very high confidence level (as used in Basel II) is typically prone to very high model risk, even if one knows the multivariate distribution almost completely.

Our results make it possible to determine which risk measures can benefit from adding dependence information (i.e., leading to narrower bounds when used to assess portfolio risk), and, hence, to identify those models for which it would be meaningful to develop accurate multivariate models.

This is joint work with Steven Vanduffel (Vrije Universiteit Brussels).

Invited Plenary Talk (Mini Course: 180 Minutes),
Monday (Sept. 8, 2014), 9:00 - 10:30 and 13:40 - 15:10

BIFFIS Enrico

Professor of actuarial finance at the Imperial College Business School, London, UK

Some old and new problems in insurance contract design

In the first part of the mini course I will consider the design of traditional life insurance contracts and variable annuities in the presence of adverse selection. I will first revisit standard approaches to modelling selective withdrawals, and then outline a model where the policyholders' mortality risk profile can be represented in terms of a frailty process shaped by the relative attractiveness of different contract benefits in different states of the world. I will present some practical examples of optimal contract design and tests for adverse selection.

In the second part of the mini course I will discuss the design of some innovative risk sharing arrangements. I will first look at longevity risk transfers, address the issue of collateralization in longevity swaps, and discuss the design of longevity linked securities that might appeal to investors more familiar with the catastrophe bond format. I will then look at Value-of-In-Force (VIF) monetization, and outline a model to compare the economic sale and contingent loan format within the Solvency II framework. The results will be illustrated with case studies based on real world portfolios of a large global insurer.

Invited Plenary Talk (Mini Course: 180 Minutes)
Monday (Sept. 8, 2014), 10:50 - 12:20, and Tuesday (Sept. 9, 2014), 10:50 - 12:20

CZADO Claudia

Professor for applied mathematical statistics at the Center of Mathematics, Technische Universität München, Munich, Germany

Pair-Copula constructions of multivariate copulas with applications

Copulas are used to characterize dependency among several components and are used to build multivariate models for financial and insurance data. The short course we will introduce the concept of copulas and discuss standard classes such as the elliptical and Archemedian copulas. These are restricted in their dependency pattern such as symmetry, tail independence or ex changeability. In contrast the flexible class of regular vine (R-vine) copula models can accommodate tail asymmetry and allow for different dependency patterns for different pairs of variables. R-vine copulas are based on a pair-copula construction (PCC) using only bivariate copulas as building blocks. Estimation, simulation and model selection are shown with examples using the R-package VineCopula, which contains functions for statistical inference of vine copulas and tools for exploratory data analysis and selection of bivariate copulas.

References:
[1] Aas, K., C. Czado, A. Frigessi and H. Bakken (2009). Pair-copula constructions of multiple dependence. *Insurance: Mathematics and Economics* 44(2), pp. 182-198.
[2] Brechmann, E. C. and U. Schepsmeier (2013). Modeling dependence with C- and D-vine copulas: The R-package CDVine. *Journal of Statistical Software* 52(3), pp. 1-27.
[3] Czado, C. (2010). Pair-copula constructions of multivariate copulas. In P. Jaworski, F. Durante, W. Härdle, and T. Rychlik (Eds.), *Copula Theory and Its Applications*. Berlin: Springer.
[4] Dissmann, J., E. Brechmann, C. Czado, and D. Kurowicka (2013). Selecting and estimating regular vine copulae and application to financial returns. *Comp. Statistics and Data Analysis* 59(1), pp. 52-69.
[5] Kurowicka, D. and R. M. Cooke (2006). Uncertainty Analysis with High Dimensional Dependence Modelling. Chichester: John Wiley.

[6] Kurowicka, D. and H. Joe (Eds.) (2011). Dependence Modeling: Vine Copula Handbook. Singapore: World Scientific Publishing Co.
[7] Schepsmeier, U., J. Stoeber, and E. C. Brechmann (2013). VineCopula: Statistical inference of vine copulas. R package version 1.2.

Invited Plenary Talk (Mini Course: 180 Minutes),
Tuesday (Sept. 9, 2014), 9:00 - 10:30 and 13:40 - 15:10

LOISEL Stéphane

Professor at Institute of Actuarial Science and Finance, University Claude Bernard of Lyon 1, France

Modeling, monitoring and managing longevity risk

In this short course, we present classical approaches and new ideas to model longevity risk using population dynamics methods.

We investigate online detection problems: how does one optimally detect changepoints in two-population longevity models under some false alarm constraint? We also discuss some financial risks associated to longevity related contracts as well as simulation issues in a risk management / Solvency II perspective.

Invited Plenary Talk (Mini Course: 120 Minutes)
Monday (Sept. 8, 2014), 16:40 - 17:40, and Tuesday (Sept. 9, 2014), 15:30 - 16:30

MÜLLER Alfred

Professor for stochastics and quantitative methods in economics at the Department of Mathematics, University of Siegen, Germany

Modeling, measuring and comparing dependent risks

In this presentation we deal with methods for modeling, measuring and comparing dependent risks. First we deal with the measurement of univariate risks by risk measures, where we follow the axiomatic approach of coherent and convex risk measures, and deal in particular with the relatively new concept of expectiles as a risk measure. Then we look at the comparison of risk measures by stochastic orders like stop-loss order and usual stochastic orders.

The main part, however, will deal with multivariate risks. After introducing the concept of copulas for modeling dependent risks, we look at methods for the comparison of dependent risks. This is an important topic for actuaries, as it helps to understand how dependence between different risks affects the aggregate risk of a business line or a whole company. We will introduce the most relevant concepts of comparing dependence of risks like supermodular ordering and orthant ordering, and we will demonstrate how mass transfer principles can be used to better understand these concepts, and to prove many interesting results.

Literature:
[1] Fabio Bellini, Bernhard Klar, Alfred Müller and Emanuela Rosazza Gianin (2014). Generalized quantiles as risk measures. *Insurance: Mathematics and Economics* 54, pp. 41-48.
[2] Alfred Müller (2013). Duality Theory and Transfers for Stochastic Order Relations. In: *Stochastic Orders in Reliability and Risk*. Lecture Notes in Statistics 208, pp. 41-57.
[3] Alfred Müller and Dietrich Stoyan (2002). *Comparison methods for stochastic models and risks*. John Wiley & Sons, Chichester, xii+330 pages.