COURSE SYLLABUS

Doctoral course: Dependence modelling using vine copulas: theory and applications, 5 credit points

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Course code:
Reviewed by: RFB
Approved by: RFB
Valid as of: 2020-02-19
Version: 1
Reference number:

Education Cycle: Third cycle, doctoral program course
Doctoral program subject: Statistics

Purpose:

Due to their flexibility, copula models are quickly gaining popularity in applied research. Copulas are descriptions of multivariate distributions whose margins are uniform. This course gives an introduction to the class of vine copulas and their statistical inference. Vine copula models have become very popular in the last years for many applications in diverse fields such as finance, insurance, hydrology, marketing, engineering, chemistry, aviation, climatology and health. This course provides an introduction to the statistical inference of vine copula models and its implementation in the statistical software R.

Intended learning outcomes:

On completion of the course, the students will be able to:

Knowledge and understanding

1. Demonstrate understanding and knowledge regarding the theoretical background of vine copula models and their statistical inference.
2. Demonstrate understanding regarding the difference between regular, drawable and canonical vines.

Skills and abilities

3. Interpret and analyze results derived from vine copula models.
4. Perform statistical tests in the framework of vine copulas to select the appropriate model.
5. Estimating vine copula dependence models using multivariate data.
6. Apply the statistical software *R* to conduct copula-based modeling and perform simulations based on the estimated model.

Judgement and approach

7. Critically evaluate the appropriateness of vine copulas in multivariate data analysis

Contents:

The course starts with a background chapter on multivariate and conditional distributions and copulas. This includes the parametric classes of elliptical, Archimedean and extreme value copulas. Their parameter estimation and graphical tools for the identification of sensible bivariate copula models to data are presented. The decomposition and construction principle of drawable (D-), canonical (C-) and regular (R-) vines is developed and discussed. The course concludes with recent extensions of vines including advances in estimation, model selection, for special data structures and reviews major applications in finance, life and earth sciences, insurance and engineering. It also provides an overview of the available software, in particular R, to select, estimate and visualize vine-based models.

Type of Instruction/Teaching format:

The course is designed as a series of lectures, seminars and computer labs.

Prerequisites:

Admitted to a doctoral program in statistics or a related subject of a recognized business school or university.

Examination and grades:

This course is examined using a course paper where a copula-based modeling of multivariate data should be performed. This paper deals with ILOs 1,2,3,4,5,6,7

The grades given are pass or fail.

Course evaluation:

A course evaluation will be conducted at the end of the course.

Literature

Claudia C, Analyzing Dependent Data with Vine Copulas: A practical Guide with R, 2019, Springer, New York.

Joe, H. (2014). Dependence modeling with copulas. CRC Press

Additional readings, to be assigned during the lectures.