

Summer school: Vine copulas and their applications in finance (August 24-28, 2020)

Claudia Czado

22 June, 2020

Content

This course will give an introduction to dependence modeling using copulas. Special focus is on the flexible class of vine copulas, which allows to model asymmetric tail dependence often observed in data examples. This class is build out of bivariate copulas using a sequence of appropriate conditioning. The course will include applications from finance and insurance. The R software packages *VineCopula* and *rvinecopulib* will be utilized.

Schedule

- Monday August 24, 2020:
 - Unit 1 (9-11am): Introduction to copulas and bivariate copula families
 - Unit 2a (2-3pm): Bivariate applications in finance and insurance using the R package *VineCopula*
 - Unit 2b(3-4pm): Exercise session/Discussion of case studies to be performed by the participants
- Tuesday August 25, 2020:
 - Unit 3 (9-11am): Multivariate copula families
 - Unit 4 (2-4pm): Pair copula constructions in three dimensions
- Wednesday August 26, 2020:
 - Unit 5 (9-11am): Regular vine distributions: Estimation and model selection
 - Unit 6 (2-4pm): Vine based financial time series analysis using the R package *rvinecopulib*
- Thursday August 27, 2020:
 - Unit 7 (9-11am): Model selection in large vines
 - Unit 8 (2-4pm): D-vine quantile regression
- Friday August 28, 2020:
 - Unit 9 (9-11am): Recent applications of vine distributions in finance
 - unit 10 (2-4pm): Presentation of the results from the case studies by the participants

Software

- R package *VineCopula*
- R package *rvinecopulib*

Books

- Joe, H. (2014). Dependence modeling with copulas. CRC press.
- Czado, Claudia. "Analyzing Dependent Data with Vine Copulas." Lecture Notes in Statistics, Springer (2019).

Some selected research papers

- Aas, K., Czado, C., Frigessi, A., & Bakken, H. (2009). Pair-copula constructions of multiple dependence. Insurance: Mathematics and economics, 44(2), 182-198.
- Bedford, T.J.; Cooke, R.M. (2002). Vines - a new graphical model for dependent random variables. Annals of Statistics. 30 (4): 1031-1068.
- Dissmann, J., Brechmann, E. C., Czado, C., & Kurowicka, D. (2013). Selecting and estimating regular vine copulae and application to financial returns. Computational Statistics & Data Analysis, 59, 52-69.
- Brechmann, E. C., & Czado, C. (2013). Risk management with high-dimensional vine copulas: An analysis of the Euro Stoxx 50. Statistics and Risk Modeling, 30(4), 307-342.
- Barthel, N., Czado, C., & Okhrin, Y. (2020). A partial correlation vine based approach for modeling and forecasting multivariate volatility time-series. Computational Statistics & Data Analysis, 142, 106810.
- Nagler, T., Bumann, C., & Czado, C. (2019). Model selection in sparse high-dimensional vine copula models with an application to portfolio risk. Journal of Multivariate Analysis, 172, 180-192.
- Kraus, D., & Czado, C. (2017). D-vine copula based quantile regression. Computational Statistics & Data Analysis, 110, 1-18.
- Fink, H., Klimova, Y., Czado, C., & St