Freie Universität Berlin
School of Business and Economics

6 ECTS Master Seminar: 10145511-06
Multivariate Statistical Methods and Applications

Winter 2023/24

Lars Winkelmann

In this seminar, you work on multivariate statistical projects including multiple testing, high-dimensional covariance matrix estimation, multivariate distribution theory and forecasting. You will broaden your background acquired during the (mandatory) lectures Econometric Analysis and either Multivariate Time Series Analysis or Financial Econometrics.

Topics include joint error-rate control in multiple testing, factor model and shrinkage methods, extreme value theory and copular models. We expect that you *independently* acquire the necessary knowledge regarding the relevant model classes, methods and/or implementations. With this seminar you will enhance your programming skills in either `EViews, R, Python` or `Matlab`.

Seminar Projects: We provide a list of topics from which you can choose. The topics are not worked out in detail. We just give some initial references. You can work on methodological aspects or run an empirical application. Even in case of an empirical project, you have to acquire the relevant aspects of a model class and associated inference procedures. A methodological project should also contain a brief empirical illustration (or simulation when more appropriate). Besides the list of topics, you are more than welcome to propose your own topic. In this case please contact us before our first meeting in October.

Structure: In the first session we will make some general remarks on the seminar and we discuss the project allocation. In preparation of the fist meeting you need to check the list of seminar topics on our blackboard page and already take a closer look at some references. We highly recommend to work in groups of two students—so find a partner beforehand. After the first meeting each group has to officially register for the seminar and confirm the assigned research topic via mail. The following weeks are reserved for individual meetings. In the week before the Christmas break, we have our second joint session with short presentations and feedback. Each group presents briefly (about 15 minutes) its topic to the fellow students. You give the (economic) motivation, explain the methodology and what you plan to do. In the following weeks you continue working on the empirics/simulations. Our final joint meeting is end of January. After a brief reminder about the topic each group presents its empirical or simulation results (with about 15 minutes presentation time). Since you should have a chance of considering the feedback to your presentations, you can submit the seminar paper until mid of March. Each group submits one seminar paper of not more than 15 pages.

Grading: The seminar paper will be weighted with 80% and both presentations with 20%. The usual grades are applied to these three parts of the examination.

Important dates:

- Introductory meeting: Thursday 19. Oct. 2023, 14:30:16:00 (K005).
- Registration deadline: 3. Nov. 2023 via mail (without this extra registration no grading).
- First presentation: Thursday 14. Dec. 2023, 14:30-18.00 (K005).
- Second presentation: Thursday 25. Jan. 2024, 14:30-18.00 (K005).
- Paper submission: 10. March 2024 via mail (including documented code, data, tex-file).

Topics:

1. **Multiple testing:**

   J. P. Romano, A. M. Shaikh, M. Wolf. Formalized Data Snooping Based on Generalized Error Rates. Econometric Theory. 404–447. 2008.

   G. Blanchard, S. Delattre, E. Roquain. Testing over a continuum of null hypotheses with False Discovery Rate control. Bernoulli. 304–333. 2014.

   N. Bouamara, S. Laurent, S. Shi. Sequential Cauchy Combination Test for Multiple Testing Problems with Financial Applications. Working paper. 2023.

   P. Bajgrowicz, O. Scaillet, A. Treccani, Jumps in high-frequency data: spurious detections, dynamics and news. Management Science 2198–2217. 2016.

   D. Banulescu-Radu, C. Hurlin, J. Leymarie, O. Scaillet. Backtesting Marginal Expected Shortfall and Related Systemic Risk Measures. Management Science. 5730–5754. 2021.

   C. R. Harvey, Y. Liu. Evaluating Trading Strategies. Journal of Portfolio Management, Special 40th Anniversary Issue. 8–118. 2014.

   C. R. Harvey, Y. Liu, H. Zhu. ... and the Cross-Section of Expected Returns. Review of Financial Studies. 5–68. 2016.

   (Menkveld et al. No Standard Errors. Journal of Finance. forthcoming)

2. **High-dimensional covariance matrix estimation:**

   O. Ledoit, M. Wolf. The Power of (Non-)Linear Shrinking: A Review and Guide to Covariance Matrix Estimation. Journal of Financial Econometrics. 187–218. 2022.

   C. Lam. High-dimensional covariance matrix estimation. Computational Statistics. 2019.

   Y. Aït-Sahalia, D. Xiu. Using principal component analysis to estimate a high dimensional factor model with high-frequency data. Journal of Econometrics. 384–399. 2017.

   J. Fan, A. Furger, D. Xiu. Incorporating Global Industrial Classification Standard Into Portfolio Allocation: A Simple Factor-Based Large Covariance Matrix Estimator With High-Frequency Data. Journal of Business & Economic Statistics. 489–503. 2016.

   J. Fan, Y. Fan, J. Lv. High dimensional covariance matrix estimation using a factor model. Journal of Econometrics.186–197. 2008.

   Archakov, I., Hansen, P.R. A new parametrization of correlation matrices. Econometrica. 1699-1715. 2021.

3. **Multivariate distributions:**

   Y. Hoga. Extremal Dependence-Based Specification Testing of Time Series, Journal of Business & Economic Statistics. 1–14. 2022.

   L. Yang. Nonparametric Copula Estimation for Mixed Insurance Claim Data. Journal of Business & Economic Statistics. 537–546. 2022.

   X. Bai, J. S. L. Lam. Portfolio value-at-risk estimation for spot chartering decisions under changing trade patterns: A copula approach. Risk Analysis. 1278–1292.

D. H. Oh, A. J. Patton. Time-Varying Systemic Risk: Evidence From a Dynamic Copula Model of CDS Spreads, Journal of Business & Economic Statistics. 181–195. 2018.

P. Embrechts, F. Lindskog, A. McNei. Modelling Dependence With Copulas and Applications to Risk Management. Handbook of Heavy Tailed Distributions in Finance. 2003.

H. Wang, Y. Yuan, Y. Li, X. Wang. Financial contagion and contagion channels in the forex market: A new approach via the dynamic mixture copula-extreme value theory. 401–414. 2021.

Adrian, Tobias, Federico Grinberg, Nellie Liang, Sheheryar Malik, and Jie Yu. The Term Structure of Growth-at-Risk. American Economic Journal: Macroeconomics. 283–323. 2022.

4. **Forecasting:**

C. Zhang, Y. Zhang, M. Cucuringu, Z. Qian. Volatility Forecasting with Machine Learning and Intraday Commonality. Journal of Financial Econometrics, 1–39, 2023.

A. Bucci. Realized Volatility Forecasting with Neural Networks. Journal of Financial Econometrics. 502–531. 2020.

A. Bucci, L. Ippoliti, P. Valentini. Comparing unconstrained parametrization methods for conditional covariance matrix prediction. Statistics and Computing, 2022.

Forecast evaluation.

R. Quaedvlieg. Multi-Horizon Forecast Comparison. Journal of Business & Economic Statistics. 40-54. 2019.

M. Knüppel, F. Krüger. Forecast uncertainty, disagreement, and the linear pool. Journal of Applied Econometrics. 23–41. 2021.

A. J. Patton. Comparing Possibly Misspecified Forecasts. Journal of Business & Economic Statistics. 796–809. 2020.

P. R. Hansen, A. Lunde, J. M. Nason. The Model Confidence Set. Econometrics. 453–497. 2011.